MACHINERY

Design—Construction—Operation

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April MACHINERY—the Annual Automotive Number—will contain, in addition to all the regular features found in every issue of MACHINERY, a selected group of feature articles covering some of the most recently developed practices in several leading automobile plants in the country. These articles will not only be of value to the automotive production engineer, but will find application in many other branches of the mechanical field as well.

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Rubber and Wood Used for Dies In Forming Airplane Parts

The Airplane Industry is Noted for the Unusual Methods it Has Developed for Producing Duplicate Parts from Sheet Aluminum and Steel. This Article Features Some of the Ingenious Practices of the Curtiss Aeroplane & Motor Co.

By CHARLES O. HERB

THE making of sheet-metal parts often presents difficult problems when the number of pieces required is small. Steel punches and dies for blanking and forming are out of the question, because their cost would be far too high in proportion to the number of parts to be produced.

There is perhaps no industry that is brought face to face with such problems oftener than the airplane building industry. Seldom are airplanes ordered in lots greater than twenty or twenty-five, and yet the sheet-metal parts of the fuselage, engine cowling, and wings must be interchangeable. Obviously, several hundred dollars is too much to expend for a die when so few pieces are required.

Some very unusual methods have been devised by the Curtiss Aeroplane & Motor Co., Inc., Buffalo, N. Y., to surmount these difficulties. Sometimes rubber pads are used instead of a punch to shape sheet metal to the contour of an inexpensive die cast from zinc. In many cases, drawing dies are constructed of wood and faced with thin sheets of cold-rolled steel. Steel-faced wooden tools are also used extensively on a large press brake. These methods and others fully as unusual will be described in this article.

An example of the use of rubber pads in combination with zinc dies or forms on a Farrel-Birmingham 200-ton hydraulic press is shown in the heading illustration. Four or five sheets of rubber 5 feet long, 3 feet wide, and 1 to 1 1/2 inches thick are attached to the head of this machine, as illustrated in Fig. 1, and the zinc die is placed on the

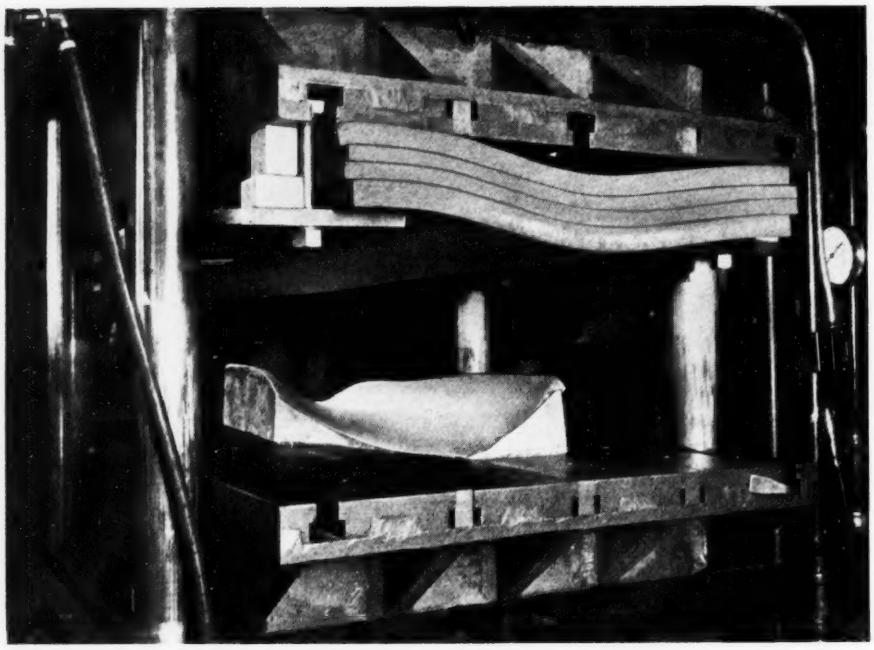


Fig. 1. Rubber Pads are Used on a Hydraulic Press to Shape Sheet Aluminum to the Contour of Zinc Dies

table. After the sheet of metal to be shaped has been laid on the zinc die, the table is raised slowly by hydraulic pressure to force the metal sheet and the die into the rubber pads.

If the piece must be drawn to a considerable depth, several table movements are made before the piece and the die are pressed into the rubber pads the full amount. Also, when a piece is formed to a considerable depth, rubber pads of small area are generally laid on the sheet metal above the greatest depth of the die, so that the pads attached to the head of the machine will not be distorted excessively.

The die side of the blank to be shaped is covered with a medium grade of D.T.E. oil made by the Standard Oil Co. This oil is applied with a brush. After the blank is placed on the die, a coating of mica powder is dusted on the side of the blank that comes in contact with the rubber pads. These provisions facilitate the sliding of the sheet metal between the die and the rubber pads and keep the die from scratching the blank. It will be observed that it is unnecessary to bolt the die to the press table. In the operation illustrated, the sheet metal was formed to a maximum depth of 6 inches. The blank was 41 inches long by 17 inches wide.

Most of the sheet metal used on Curtiss airplanes is aluminum alloy. Much of it is the annealed alloy known as Alco 24-SO, having an ultimate tensile strength of 26,000 pounds per square inch and an elongation of 20 per cent in 2 inches. Its hardness is Brinell 42. However, by the time that a part has been formed from this alloy, the working of the sheet metal has increased its tensile strength

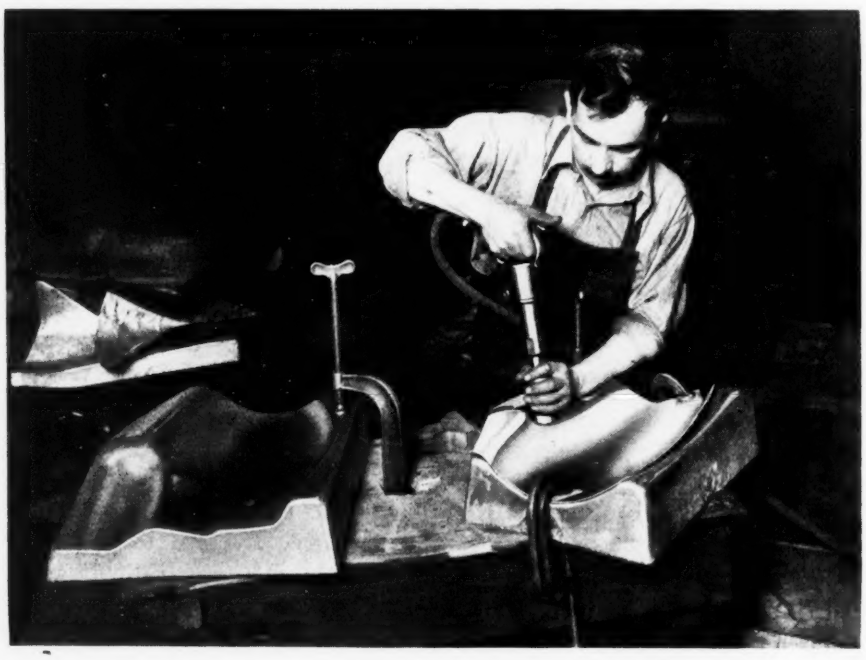
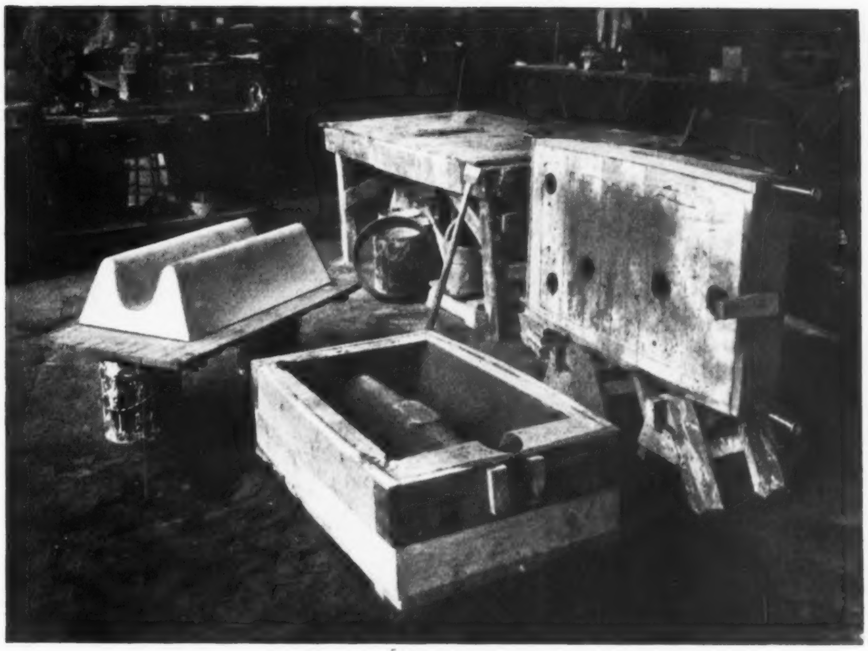


Fig. 2. Sheet-metal Parts are Also Produced by Using Hand Tools to Shape Them on Zinc Forms

Fig. 3. Plaster-of-paris Pattern and Mold from which a Zinc Die Weighing 1200 Pounds was Cast



to perhaps 50,000 pounds per square inch; hence, the method of shaping sheet metal just described could undoubtedly be applied to sheet steel of low or medium strength. Most of the sheet aluminum alloy worked on the hydraulic press is 0.040 inch thick.

The life of the rubber pads depends to a considerable extent on the amount that they are displaced locally during the forming operations, or, in other words, upon the maximum depth of the zinc dies. However, they generally last for several months.

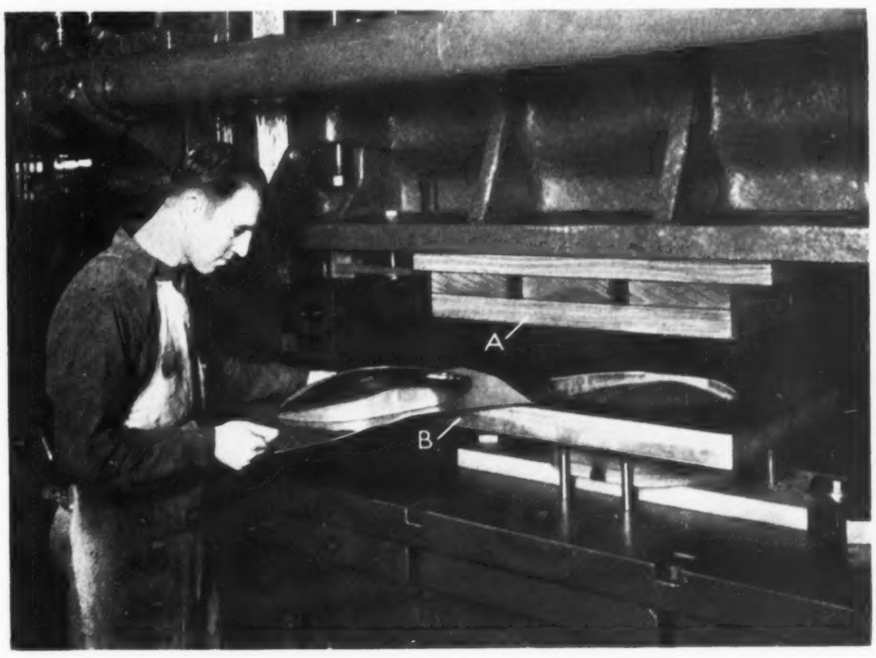
When there is a great deal of work ahead of the hydraulic press or when the sheet-metal pieces to be formed are of such a shape that they cannot be readily produced on the press, hand tools are often used to shape the metal to zinc forms. A typical operation is illustrated in Fig. 2, where a pneumatic riveting hammer fitted with a rawhide covered wooden head is shown being used to pound the sheet metal into the depressions of a zinc form.

Rawhide covered tools or plain wooden tools such as mallets are used in hand working, so as to avoid marking the sheet metal. If scratches were produced in these operations, they would probably be the start of fractures that would develop after the airplane had been placed in operation.

How the Zinc Dies and Forms are Produced

The zinc die or form for any part is made by either of two methods. The first consists of shaping and fitting a sample piece by hand to one of the airplanes on which it is required until the correct contour and dimensions are obtained. Then a

Fig. 4. Drawing Dies of Wood with Drawing Edges of Cold-rolled Steel are Used for a Variety of Shapes



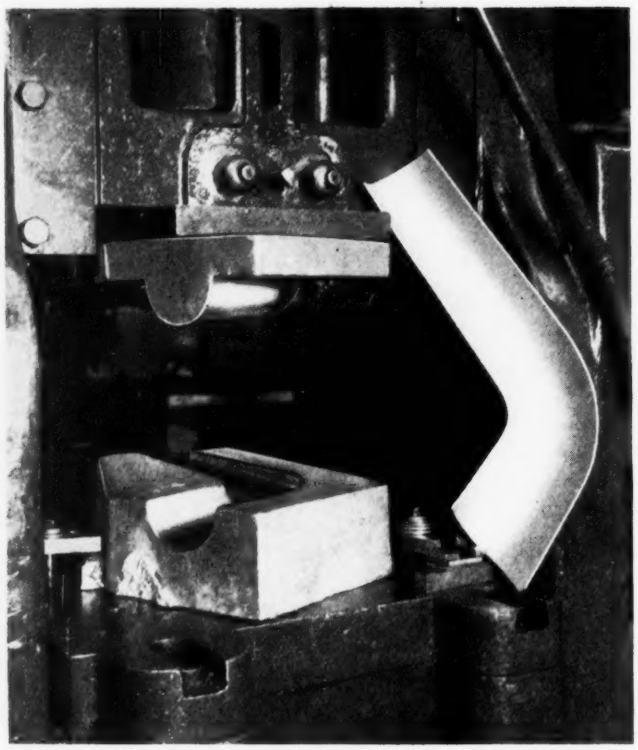


Fig. 5. Zinc Punches and Dies Provide an Economical Method of Forming Small Quantities of Stainless Steel Parts

plaster-of-paris pattern is cast from this "tailored" piece for use in making a mold in sand. Zinc is poured in the sand mold to obtain the die or form for producing the remaining number of required parts.

This method is all right for general work, and is the one most commonly used; however, if extreme accuracy is required, a "contour basket" is laid out to exact dimensions with a rule that allows for the shrinkage of zinc castings. This basket consists of thin steel plates formed to the required contour at various points and fitted together. A plaster-of-paris pattern is poured to fit this form and used in making a mold for the zinc casting.

In Fig. 3 a plaster-of-paris pattern is seen in the left background, the mold produced from it in the foreground, and the cover for the mold at the right. There are five gates 4 inches in diameter in the cover. The zinc die produced in this mold weighed approximately 1200 pounds. It is the practice to cast all of the zinc dies and forms solid.

The zinc is melted in a gas furnace and poured at a temperature of from 980 to 1050 degrees F. Experience has proved that if the molten zinc is hotter than the maximum temperature given, excessive shrinkage will result in cooling. On the other hand, if the pouring temperature is lower than the minimum limit, the metal will not flow fast enough to give a solid casting.

These zinc castings require only a small amount of smoothing to prepare them for service. Zinc is used for the dies and forms because it is easy to cast and because it stands up surprisingly well under the service demanded of it. When the required number of pieces of one kind have been produced, the zinc die is remelted and the metal recast into other dies or forms, so that there is no loss of the metal. The oftener that the zinc is used, the harder and tougher it becomes and, therefore, the more satisfactory for sheet-metal forming operations. This is due perhaps to the impurities that get into the metal with its continued use.

Zinc punches are used in combination with zinc dies for shaping pieces of stainless steel and aluminum alloy. Such an operation is shown in Fig. 5,

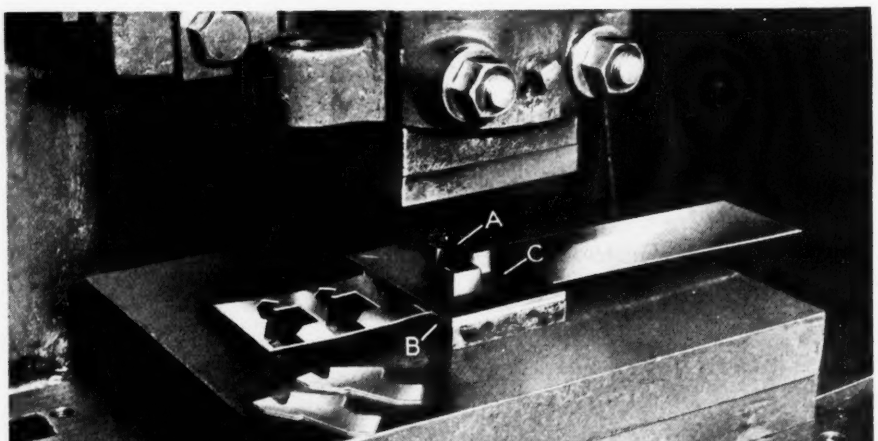
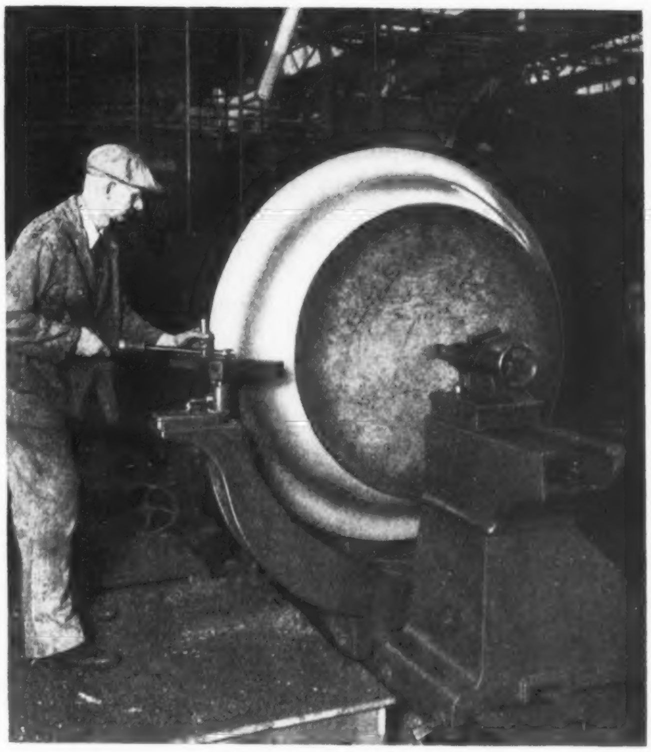


Fig. 6. Simple Punches and Dies of Cold-rolled Steel, Cyanide-hardened, are Used to Blank Chromium - molybdenum Steel

Fig. 7. Spinning a Cowl Ring 54 Inches Outside Diameter from Two Sheets of Aluminum Alloy Welded Together



a finished piece being seen at the right. The machine is a standard punch press.

In this operation, stainless steel 0.040 inch thick is shaped to radii of approximately 2 inches. The over-all length of the piece is about 21 inches. The blank is cut out to produce the elbow. In the forming operation, the piece is first shaped to within about 1/8 inch of the required radii, after which it is annealed and trimmed. It is then returned to the same die, which is set for forming to the finished size. Right- and left-hand pieces are produced in separate dies, and these pieces are butt-welded together to form a tubular unit.

If standard dies constructed of alloy steel had been used for this operation, they would have cost between \$300 and \$400. The labor cost in making the zinc die set was only \$20 or \$25. There was no material cost, because the zinc was melted from previous dies.

Another advantage of zinc punches and dies is that, in the event that the work-piece is modified, a new set of tools can be readily provided at low cost. At the time that the photograph shown in Fig. 5 was taken, 80 pieces of stainless steel had been produced by the punch and die, and the tools appeared as good as new.

Dies constructed of wood and faced with sheets of cold-rolled steel 3/16 inch thick are used extensively for drawing pieces from sheet aluminum alloy. Such an operation is shown in Fig. 4. The lumber used in the construction of such dies generally has a nominal thickness of 2 inches and is approximately 1 5/8 inches thick in the planed condition. Maple and yellow or red birch are used, because these woods have a high compressive strength parallel with the grain. White birch does not possess the necessary strength.

These wooden tools effect about as great an economy as the zinc tools. For instance, the punch and die shown in Fig. 4 could not have been produced for less than \$250 or \$300 if they had been made in the conventional manner, whereas the wooden steel-faced punch and die cost only \$50.

In this die set, the aluminum sheet is clamped between punch *A* and the sheet-holder *B* at the be-

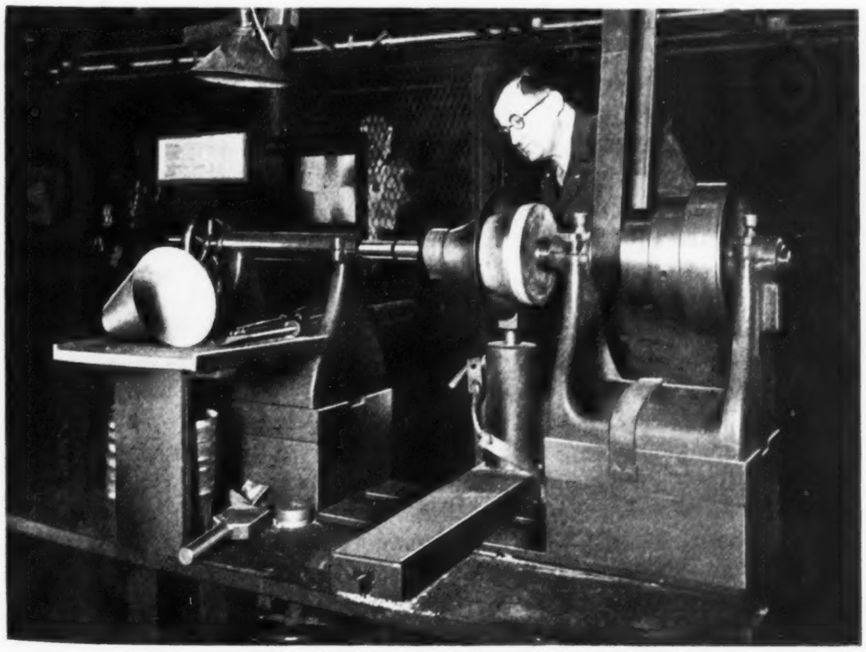


Fig. 8. Spinning Still Remains the Most Economical Method of Producing Deep Sheet-metal Shells Required in Small Quantities

ginning of the operation. As the ram descends the sheet-holder moves down with the punch, so that the sheet is drawn gradually over the wooden block in the center of the holder, the punch being hollowed out to correspond with the wooden form in order to draw the part to the required depth. Six pneumatically operated rods force holder *B* and the sheet against the face of the punch. The sheet-holder is also supplied with a steel facing on the under side to prevent gouging of the wood by the rods. The steel faces of the punch and holder are rounded along the edges that draw the metal, so that the sheet will slide smoothly over these edges.

Long pieces of sheet metal are shaped in a press brake which has a span of 10 feet. Wooden tools provided with thin steel plates on the edges that come in contact with the work are used invariably on this machine. These wooden tools will shape up to 500 or 600 pieces successfully. They are usually built up of several pieces of lumber.

Wooden forms and blocks are also used extensively in a number of tube-bending machines for limited quantities of work. They have proved fully as satisfactory as metal forms, and are, of course, much cheaper.

Inexpensive Methods of Obtaining Sheet-Metal Blanks

It frequently happens that sheet-metal blanks of a certain shape are required in quantities as small as ten or even less. When the material to be blanked is an aluminum alloy or brass, a templet is often made of 1/8-inch cold-rolled steel, with a sharp edge around its entire periphery. This templet is laid on the table of the hydraulic press shown in the heading illustration, with the sheet metal to be blanked on top. When the table is raised to press the sheet and the templet into the rubber pads, the sheet metal is sheared off to the outline of the templet. While this method has not been tried on steel, it is believed that it would be applicable to thin sheets of mild steel.

Chromium-molybdenum steel pieces in thicknesses up to 1/4 inch are blanked by inexpensive dies of the type shown in Fig. 6. A templet *A* is first made of cold-rolled steel from 1/2 to 3/4 inch thick, and another piece of the same material is cut out correspondingly to serve as a die *B*. A stripper plate *C* is also provided. Templets *A* and *B* are cyanide-hardened.

In using these tools on a power press, the strip of sheet metal to be blanked is slipped between the die and its stripper plate, as shown, and the punch is laid in the opening of the latter. Then the press is operated to impart a quick blow to punch *A*, so as to cut the blank from the stock. For the next piece, the punch is merely lifted by the operator, and the sheet advanced in the die.

Such a die set can be used for blanking up to 150 pieces from chromium-molybdenum steel. The set illustrated cost only $30, whereas the conventional die for such a job would cost at least $100.

Large and Small Shells are Spun on Wooden Forms

Spinning is resorted to for shaping sheet-metal pieces of small diameter that are too deep to permit drawing in a punch press, and also for pieces of such large dimensions that drawing would be impracticable. Wooden forms are used entirely in the spinning operations.

In Fig. 8, the operator is seen spinning a tapered cup which varies in diameter from 4 to 9 inches, the over-all length being 8 inches. At the beginning of this operation, a 12 7/8-inch disk of 0.050 inch thick Alco 4-SO aluminum alloy is clamped against the face of the wooden form by a round block of wood attached to the tailstock spindle. Standard spinning tools are used to force the metal gradually down on the form. It takes about five minutes to spin the tapered cup, the operation being performed at the speed of 1500 revolutions per minute.

Cowl rings up to 57 inches maximum diameter have been spun with the equipment shown in Fig. 7, but 60-inch rings could be spun. The particular ring illustrated had a maximum diameter of 54 inches when finished. It was also produced from Alco 4-SO aluminum alloy, 0.050 inch thick. The work comes to this spinning machine in the form of a tapered ring which is produced by welding together two sheets of the aluminum alloy. The width of this ring is 14 1/2 inches, and the diameter of the small end, approximately 40 inches.

This spinning operation is performed at a speed of about 400 revolutions per minute. When the metal has been spun back on a large wooden form to the shape shown, the cowl ring is taken from the lathe and annealed to relieve the stresses that have been created. After the annealing, the cowl ring is brought back to the machine and the spinning operation is completed by forcing the flange that remained around the large end down on the wooden form, so as to obtain a cup-shaped piece with straight sides.

The large wooden form is fastened to a steel disk, 1/4 inch thick, which is nearly as large in diameter as the wooden form. To this disk a steel flange is bolted which holds the form on the spindle of the machine. Wood is used for these large forms not only because a metal form would be too bulky and heavy, but also because the wood keeps the metal from slipping and prevents scratching the sheet being formed. In addition, there is a small amount of "give" to the wood, which allows the sheet metal to set. A large-diameter wooden disk is used to clamp the work against the wooden form.

The total time of the two spinning operations on the ring cowl is about four hours. Beeswax, hard cup-grease, or soap is used as a lubricant in the spinning operations.

In building different types or models of airplanes in the Curtiss plant, samples are made of each part which are retained indefinitely, so that duplicate pieces can always be supplied for replacements.

Getting the Best Results from Coolants for Machining Operations

This Article, Based on the Practice of a Well-Known Company, Contains a Number of Valuable Suggestions on a Subject on which Information is Much Needed in Industry

By O. L. MAAG, Lubrication Engineer
The Timken Roller Bearing Co., Canton, Ohio

COOLANTS for screw machines, grinding machines, and the like cover a wide range of compounds. Among these are soluble salts, various soaps used in conjunction with water, soluble oils and water, mineral oils, fatty oils, and combinations of mineral and fatty oils, together with compounded oils containing fats, as well as mineral oils containing sulphurized and chlorinated products. The Timken Roller Bearing Co. makes use of a wide variety of these coolants and has studied their properties thoroughly.

The type of steel being machined or ground, the exactness or precision of the operation, the kind of finished surface required on the product, the speed of operation, etc., all have a bearing on the coolant to be used. Likewise, the effect of the coolant on the cutting tool or grinding wheel must be taken into consideration. No one coolant can be universally satisfactory. However, as the final quality of the product, as well as the production rate, may be controlled to a large measure by the coolant selected, it is well to give serious consideration to the problem, and, if necessary, experiment until the right type of coolant has been found.

Water and Mild Alkalies as Coolants

While water is one of the best coolants, it is often unwise to use it alone, for parts machined or ground with water alone are likely to rust too soon after being finished. To retard the rusting of finished material, mild alkalies are often used. These have the additional advantage of being cleansing agents, keeping the parts clean as well as preventing the loading of grinding wheels.

When the machining operation is one not requiring great accuracy, such as the sizing and smoothing up of large forgings, deep slow cuts may be taken without the use of any coolant whatever. Ordinarily, however, some advantage is obtained in operations such as this by using either water as a coolant or water to which one-half to two ounces of soda ash per gallon, or a small percentage of trisodium phosphate, has been added.

Likewise, when removing only part of a surface by grinding, it is not necessary to use a coolant, as for example, in removing seam scabs from steel bars. However, if it is desired to obtain a certain size and finish, and prevent distortion and drawing of temper, as well as hold the finished size to close dimensions, a coolant is needed. When a clean, free-cutting operation is desired and it is essential to hold dimensions to the close tolerances demanded in the bore of roller bearings, a properly bonded cutting wheel and one of the mild alkali water solutions can be used to advantage. If a special finish is desired, weak soap solutions or soluble oil mixtures often give better results. It is, however, necessary to work out the proper combination of wheel, coolant, and speed of grinding for the particular kind of surface finish demanded.

Importance of Maintaining a Uniform Temperature of the Coolant

The part played by coolants in keeping uniform temperatures on machines, tools, and articles being ground or machined should not be underestimated. More uniform articles can be obtained when a large volume of coolant is used, as it is not subjected to the comparatively quick changes in temperature that occur when a small volume is used. Experience at the Timken plant has indicated that satisfactory results are obtained when the coolant is maintained at atmospheric temperatures, or approximately at from 70 to 85 degrees F.

Large volumes of coolants also have the advantage that foreign matter and dirt is carried away from the machines and settled out before the fluid is returned, thus insuring a cleaner and more uniform coolant, as well as a better finish and better operating conditions. However, when it is not possible to handle a large quantity of liquid, because of space or other limitations, many of the advantages inherent to large volume can be secured through the proper use of filters or centrifuges, which separate foreign matter from the coolant before it is used again.

Where it is not convenient to circulate a large volume of cutting fluid, it is possible to hold down the temperature by artificially cooling the lubricant. Circulating cold water through pipe coolers over which the coolant flows produces remarkable results and can be used to advantage in many cases.

The results obtained in the Timken plant by cooling cutting oils for use in connection with automatic screw machines emphasized the importance of carrying away the heat generated on such operations. The control of the temperatures reflects itself not only in longer tool life, but also in the precision and uniformity of the articles produced. In certain cases, an increase of 10 per cent in production was secured after the cooling system had been installed.

At the Timken plant, cutting oil is washed from the chips by means of hot water (118 to 125 degrees F.), the oil being separated from the water by gravity. The oil is then heated to 180 degrees F. to sterilize it, and centrifuged to throw out any remaining dirt and water, after which the clean, sterilized oil is returned for use on screw machines.

Even if an abundance of coolant is directed on the work in a machine, its temperature in a screw machine will gradually build up to as high as 125 degrees F., if provision is not made for cooling it before recirculation. This is too high a temperature for good results, and experiments were conducted to determine what temperature would be satisfactory. These tests showed that if the coolant could be maintained at a uniform temperature of approximately 80 degrees F., satisfactory results would be secured. The necessary arrangements were made to maintain this temperature, and the results have fully justified the effort.

Oil Cutting Compounds and Coolants

Many oil companies have cooperated in the study of cutting lubricants and coolants, and have developed a number of new mixtures and compounds for the purpose. Mixtures of fatty and mineral oils, and sulphurized fatty and mineral oils are now used successfully in many places, but investigation is being continued in an effort to still further improve the efficiency of various machining operations. Recently certain chlorinated products have shown marked promise in this field. Chemical compounds such as hexachlorethane of the aliphatic or chain series, chlorinated dyphenyl of the single ring compounds, chlorinated naphthalenes and chlorinated retenes of the double ring series have already shown merit in machining alloy steels.

In machines where good oils are used as the coolant, there is seldom any difficulty with sticky slides or with rusting and sticking of other machine parts. However, when the coolants contain water, more care must be exercised to keep the machines operating properly. Unless extreme precautions are taken in making proper bearing closures, some of these water coolants (soda water, soluble oil mixtures, etc.), will get into the bearing housings, replacing some of the bearing lubricant. The machine builders usually know what type of coolant will be used, and in building their machines take care to see that proper bearing seals are used.

The paint used for coating machinery on the outside surface, as well as that used for sealing bearing housings, must be of the right type, the choice being governed by the service under which the machine operates. There are a number of paints that are satisfactory when straight mineral oils are used, but when compounded oils or soluble oil preparations, as well as mild alkali solutions, are employed, it is more difficult to find a satisfactory paint. Studies are now in progress to find out how to overcome these difficulties and to determine the limitations of the various kinds of paints.

Should the paint come off a machine part, it will contaminate the coolant or lubricant, and may clog oil-feed lines, causing damage to the bearings. Consequently, it is essential that the machine tool builder consider this point. Similarly, the user should give this factor consideration when selecting the coolant to be used.

Maintaining Cutting Oils Fresh and Free from Contamination

When using coolants of the soluble oil type, it is essential that they be kept fresh, for if allowed to stand, the oil will break down in many cases and become rancid and evil smelling. Normal circulation will usually provide sufficient aeration to keep the solution fresh and sweet, and for this reason the circulating pumps should be kept in operation at all times, particularly in warm weather, never stopping when the plant is closed on week-ends or holidays. If circulation and aeration is not maintained, even a day may start stagnation. This occasionally can be overcome by starting the pumps, but usually the tanks have to be cleaned and new coolant made up before work is resumed.

Another factor that must be considered in connection with the use of coolants is that of dermatosis. Even though many of the mixtures and compounds used are neutral or even mildly antiseptic, provision should always be made for sterilizing the cutting oil at more or less frequent intervals. This is particularly important when more than one machine is supplied with coolant from the same source, for a single case of skin disease could easily contaminate the supply for all machines, and thus cause an epidemic that might be difficult to control.

All coolants are checked periodically for bacteriologic content at the Timken plant and the men are supplied with clean towels, good soap, and plenty of hot water. They are cautioned to wash thoroughly before leaving the plant, particularly in cold weather, so that any ingrained dirt will be cleaned out of the pores while they are still open, thus avoiding any chance of festering or infection. Our experience indicates that cleanliness is the most important factor in preventing skin infections.

Good Drawings Depend on Good Checking

Directions for Checking to Insure that Drawings are Completely Dimensioned, Easily Read, and Accurate

By FORREST E. CARDULLO, Chief Engineer
The G. A. Gray Co., Cincinnati, Ohio

MANY firms doing shop work from drawings do not realize the value of having these drawings in such a form that they are easily read and understood, and complete and accurate in all respects. In an endeavor to reduce the item of "unproductive labor," drawings are often poorly made and frequently not checked. Usually dependence is placed upon the knowledge of the foreman or the workman for much information, the lack of which may delay work and take many hours to obtain. Misleading, incorrect, or imcomplete information results in spoiled work and wasted time in the shop, delays in delivery of product, and in costly trips and telephone conversations.

While it is desirable to keep engineering expense at a minimum, this is poor economy if it increases shop costs unduly, wastes the time of busy executives, or slows down the pace of the workers through uncertainty about what is wanted. This slow pace is sure to be carried over into other work, even where full information is available. In view of these facts, the making of poor drawings, incomplete in their information and likely to contain errors, does not pay. In the words of the proverb, it is "penny wise and pound foolish."

A well-known machine tool manufacturer, realizing the importance of readily understood, complete, and accurate drawings in saving shop time and losses of material, has given special attention to the proper conveying of engineering information to the workmen, through drawings neatly executed, easily read, and complete in every detail, so that no question need arise in the shop after the drawings are issued. All questions of shop procedure are settled beforehand, as far as possible, and embodied in the drawings.

In order that the drawings may have the high standard of excellence desired, a set of instructions, as given in the following, has been issued to the checkers, and also to the draftsmen and tracers, in the engineering department. This department is small, and consequently many questions which in a large organization would be submitted to a metallurgist or a squad leader are referred to the chief engineer.

The purpose of issuing the instructions to the draftsmen and tracers, as well as to the checkers, is to train these men to become more skillful in their own sphere and to prepare them to undertake future responsibility. It is, of course, assumed that the preliminary design has been carefully gone over by an engineer while the lay-out is being made to see that stresses are not too high and deflections are not too great.

As a result of adherence to the rules given, very few mistakes are to be found in the checked drawings and few mistakes are made in the shop. On several occasions, the first machine of a new design, involving many hundred different parts, has been assembled and found to function perfectly without a single error being discovered either in the engineering or in the shop work.

Instructions for Checking Drawings

Issued by a Well-Known Machine-Building Company

The following instructions, while issued primarily to checkers, are of value to designers, detailers, and tracers. Each man should check his own work and not depend upon the checker to detect errors. The draftsman or tracer is jointly responsible with the checker for all errors, and the fact that a tracing is checked does not relieve the draftsman of this responsibility. Draftsmen and tracers should form the habit of critically reviewing the lay-outs or drawings submitted to them and of critically checking their own work, not only to eliminate errors, but also to improve their knowledge of their work and their value to their present and potential employers.

In checking any part, assemble all lay-outs showing the part, and as far as possible, prints or drawings of parts associated with the part to be checked. As a guide, if possible, procure prints of parts previously used for similar service.

Use a black and white print of the tracing to be checked, and do the checking on this print, so that a permanent record of the checking will be made. This rule is mandatory, except that a pale blue print may be substituted in case of emergency.

Inspecting a New Design

In case a new design is involved, first inspect the lay-outs carefully to see that the parts function correctly under all conditions, that they

have the proper relative proportions, that the general design is correct in the matters of strength, rigidity, bearing areas, appearance, convenience of assembly, and direction of motion of the parts, and that there are no interferences. Consider the design as a whole to see if any improvements can be made. If the design appears to be unsatisfactory in any particular, or improvements appear to be possible, call the matter to the attention of the chief engineer.

Checking for Strength

Inspect the design of the part being checked for strength, rigidity, and appearance by comparing it with other parts for similar service, giving preference to the later designs in such comparison, unless the later designs are known to be unsatisfactory. If there is any question regarding the matter, compute the stresses and deformations or find out whether the chief engineer has approved the stresses or deformations that will result from the forces applied to the part in service. In checking parts that are to go on a machine of increased size, be sure that standard parts that have been used on similar machines and that it is proposed to use on the larger machine, have ample strength and rigidity under the new and more severe service to which they will be put.

Materials Specified

Consider the kind of material required for the part and the various possibilities of molding, forging, welding, or otherwise forming the rough part from this material. Then consider the machining operations to see whether changes in form or design will reduce the number of operations or the cost of machining.

See that parts are designed with reference to the economical use of material, and whenever possible, utilize standard sizes of stock and material readily obtainable from local dealers.

In the case of alloy steel, special bronze, and similar materials, be sure that the material can be obtained in the size required.

Method of Making Drawing

Inspect the drawing to see that it is made in the third angle of projection, and that the projections and sections are made in such a way as to show most clearly the form of the piece and the work to be done on it. Make sure that any workman looking at the drawing will understand what the shape of the piece is and how it is to be molded or machined. Make sure that the delineation is correct in every particular, and that the information conveyed by the drawing as to the form of the piece is complete.

Checking Dimensions

Check all dimensions to see that they are correct. Scale all dimensions and see that the drawing is to scale. See that the dimensions on the drawing agree with the dimensions scaled from the lay-out. Wherever any dimension is out of scale, see that the dimension is so marked. Any case where the dimension, the scale of the drawing, and the scale of the lay-out do not agree is open to suspicion and is to be thoroughly investigated. All dimensions not to scale must be underlined on the tracing.

In checking dimensions, note particularly the following points:

See that all figures are correctly formed and that they will print clearly, so that the workmen can easily read them correctly.

See that the over-all dimensions are given.

See that all witness lines go to the correct part of the drawing.

See that all arrow points go to the correct witness lines.

See that proper allowance is made for all fits in accordance with the rules hitherto made for the instruction of the engineering department.

See that the tolerances are correctly given, where necessary.

See that the tolerances are not so large that incorrect fits will result.

See that all dimensions given agree with the corresponding dimensions of adjacent parts.

Be sure that the dimensions given on a drawing are those that the machinist will use, and that the workman will not be obliged to do addition or subtraction in order to obtain the necessary measurements for machining or checking his work.

Avoid strings of dimensions where errors can accumulate. It is generally better to give a number of dimensions from the same reference surface or center line.

When holes are to be located by boring on a horizontal spindle boring machine or other similar machine, give dimensions to centers of bored holes in rectangular coordinates and from the center lines of the first hole to be bored, so that the operator will not be obliged to add measurements or transfer gages.

Checking Assembly

See that the part can be readily assembled with the adjacent parts. If necessary, provide tapped holes for eyebolts and cored holes for tongs, lugs, or other methods of handling.

Make sure that, in being assembled, the piece will not interfere with other pieces already in place.

Make sure that the assembly can be taken apart without difficulty.

Make sure that the piece never, at any time, comes in actual contact with another piece, except in the case of press, bolting, and running fits.

Be sure that no parts of two moving pieces occupy the same space at the same time.

Be sure that the sum of a number of tolerances is not so great as to permit two pieces that should not be in contact to come together.

Be sure 0.020 inch tolerance on all dimensions given in vulgar fractions to finished surfaces will not result in contact or interference.

Checking Castings

In the case of castings, study the form of the pattern, the methods of molding, the method of supporting and venting the cores, and the effect of draft and rough molding on clearances.

Be sure that rough surfaces do not come too close to other parts.

Avoid undue metal thickness, and especially avoid thick and thin sections in the same casting.

Indicate all metal thicknesses, so that the molder will know what chaplets to use for supporting his cores.

See that ample fillets are provided, and that they are properly dimensioned.

See that the cores can be assembled in the mold without crushing or interference.

See that castings that must fit together are properly designed and dimensioned, so that the outer casting does not overlap the inner one.

See that swelling, shrinkage, or misalignment of cores will not make trouble in machining.

See that the amount of finish is indicated.

See that there is sufficient finish on large castings to permit them to be cleaned up, even though they warp.

In the case of such castings, make sure that the metal thickness will be sufficient after finishing, even though the castings do warp.

Make sure that sufficient sections are shown so that the patternmakers and molders will not be compelled to make assumptions about the form of any part of the casting. This is particularly important when a number

of sections of the casting are similar in form, while others differ slightly.

Checking Machined Parts

Study the sequences of operations in machining and see that all finish marks are indicated.

See that the finish marks are placed on the lines to which dimensions are given.

See that methods of machining are indicated where necessary.

Give all drill, reamer, tap, and rose bit sizes.

See that jig and gage numbers are indicated at the proper places.

See that all necessary bosses, lugs, and openings are provided for lifting, handling, clamping, and machining the piece.

See that adequate wrench room is provided for all nuts and bolt heads.

Avoid special tools, such as taps, drills, reamers, etc., unless such tools are specially authorized.

In the case of threaded parts, see that good taps and dies are available.

Where parts are right- and left-hand, be sure that the hand is correctly designated.

When possible, make parts symmetrical, so as to avoid having them right- and left-hand, but do not sacrifice correct design or satisfactory operation on this account.

When heat-treatment is required, the heat-treatment should be specified. Consult the chief engineer about heat-treatment for such parts.

Check the title, size of machine, the scale, and the drawing number on both the drawing and the drawing record card.

In checking new drawings, do not follow old drawings when improvements can be made. Bring desirable changes to the attention of the chief engineer.

Threading Two-Ton Oil-Well Pipes on Heavy-Duty Turret Lathes

Turret Lathes Equipped with Powerful Headstocks and Hydraulic Chucks Solve Problem of Machining Special Threads and Sealing Areas on 40-Foot Lengths of Forged Steel Pipe

By LORENZ LEIFER

UNUSUAL or difficult machining problems, such as the threading operations for which the machine shown in the accompanying illustrations was adapted, are responsible for many advances in machine tool design. In this case, oil-well pipes, 11 3/4 inches in diameter and 40 feet long, weighing up to 4000 pounds, required accurate machining and threading on each end. When confronted with the problem of furnishing equipment for the Spang-Chalfont Co., Pittsburgh, Pa., which would handle this difficult work, the Gisholt Machine Co., Madison, Wis., decided to adapt two Gisholt heavy-duty turret lathes for the job.

These lathes were to be set end to end, but not in line, about 50 feet apart, and so positioned that the pipe could be taper-turned and threaded on one end in one machine and then transferred to the spindle of the second machine to be taper-bored and tapped on the other end. The free end of the pipe was to be supported on roller rests.

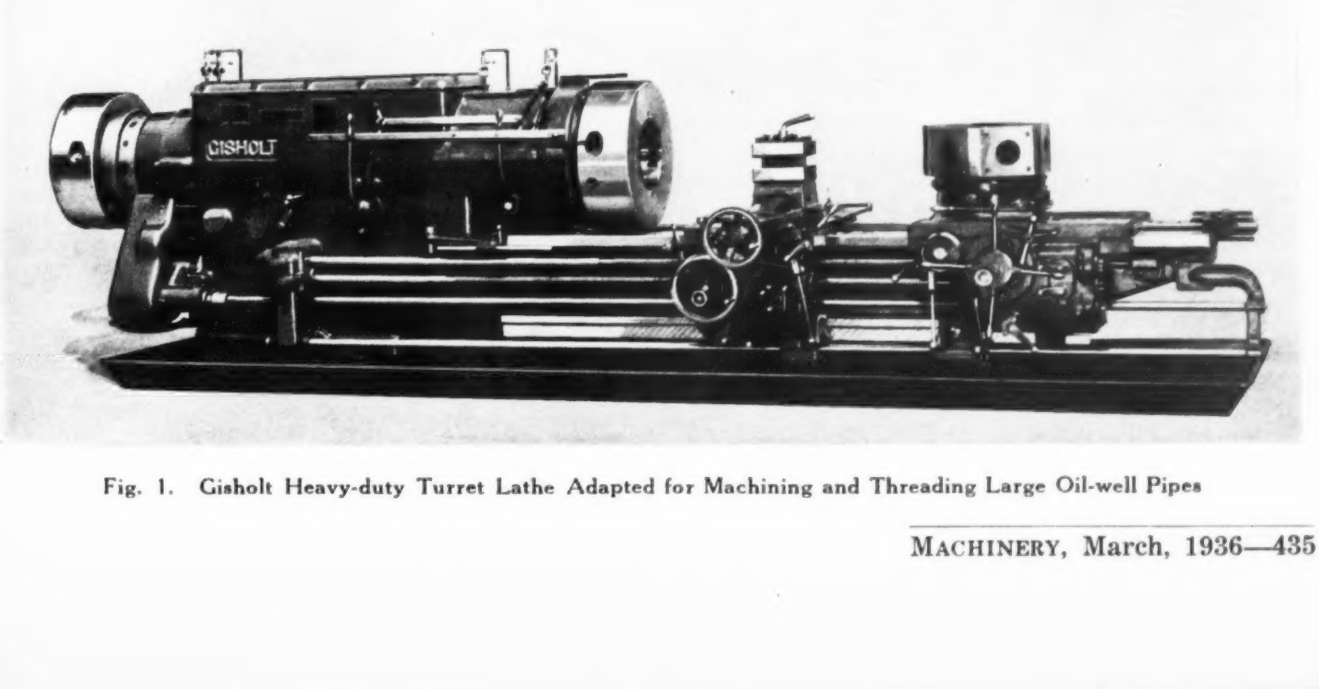


Fig. 1. Gisholt Heavy-duty Turret Lathe Adapted for Machining and Threading Large Oil-well Pipes

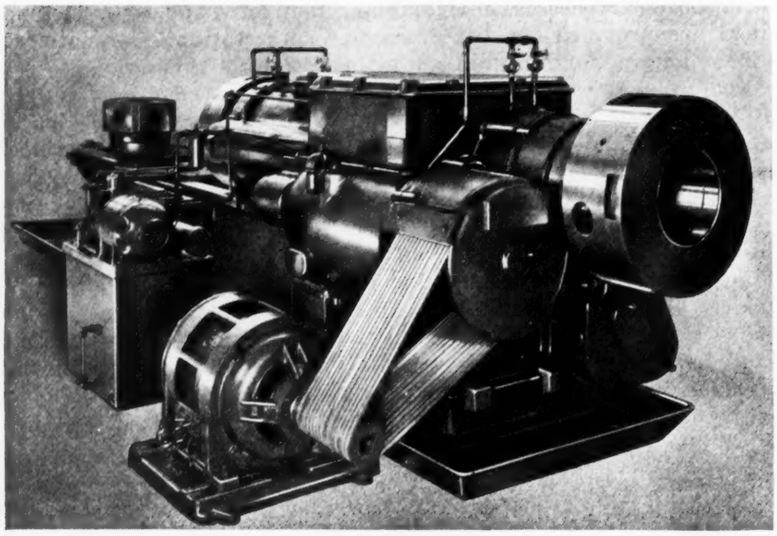


Fig. 2. Rear View of Lathe Illustrated in Fig. 1, which Shows Spindle Drive and Motor-driven Hydraulic Equipment for Operating the Chucks at Each End of the Spindle

Since a forged steel pipe 40 feet long is certain to have a number of bends and kinks in it, it will exert a tremendous force against the spindle bearings when turning on the rollers. The pipes, when assembled, were required to withstand great pressures and to have a very high torsional strength. It was necessary, therefore, to machine a specially designed, very strong and accurate thread, as well as perfect sealing areas on each end. The machining was held to close limits and was required to pass a rigid inspection. These conditions and requirements necessitated the use of a machine having a number of radical departures from conventional designs.

In order to prevent distortion of the pipes while machining the ends, the chuck at the head end of the spindle was required to exert merely enough pressure to centralize the work. The entire load of the cut and the tremendous forces resulting from the weaving action of the free end of the pipe were to be carried by a second and very powerful chuck mounted on the tail end of the spindle, as shown in the illustrations.

Contrary to the usual practice, the greatest load, in this case, was to be carried by the rear rather than the front spindle bearing. In order to further separate the working area on the pipe from the point of greatest distortion, the spindle, which had a 12 3/4-inch bore, was made to the extraordinary length of 94 inches. The headstock of the machine was cast integral with the bed, and was made 76 inches long, in order to provide adequate support for such a large spindle.

This uncommon method of distributing the enormous loads made it necessary to design the rear spindle bearing to carry most of the load. Tapered-sleeve bearings, babbitt-lined, each 20 inches in length, were used at both the front and the rear of the spindle. These huge bearings contained approximately 100 pounds of babbitt, and provided a bearing area of over 1000 square inches each.

To thoroughly lubricate the spindle and headstock bearings and gears, a forced-feed oiling system was incorporated in the machine. This system contributed to the maintenance of accuracy of the spindle alignment by minimizing temperature changes in the spindle bearings.

The problem of finding a chucking system that would combine rapid clamping with adjustability of the jaw pressures, allow the jaws to automatically regain their grip in case of slippage, and yet leave the spindle open for the work, presented the greatest difficulty encountered. It was necessary to devise a means whereby power could be transmitted through some flexible medium to the chuck bodies to be reconverted into power for advancing the jaws. The use of oil under pressure seemed to be the only solution. Accordingly, a hydraulic chuck was devised which contained the hydraulic pistons in the chuck proper.

These hydraulic pistons worked directly on the

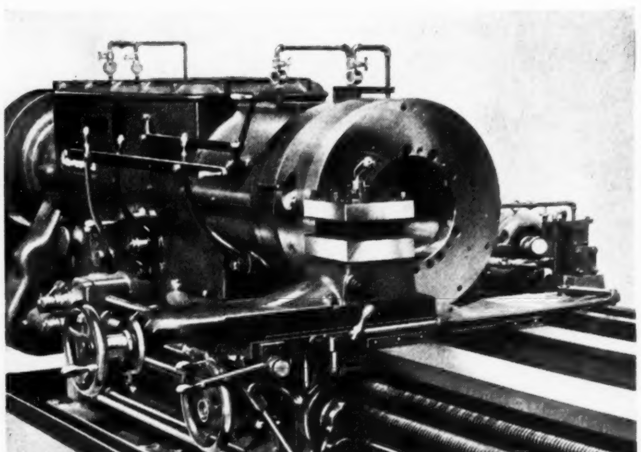


Fig. 3. View Showing Carriage and Chuck at Machining End of Heavy-duty Turret Lathe Equipped for Threading Oil-well Pipes Forty Feet in Length by About One Foot in Diameter

jaws through a cam-ring in such a way as to have a very high efficiency of conversion. The oil was led into the spindle through a distributor, then through holes drilled longitudinally in the spindle walls to the chucks, thereby leaving the spindle open to hold the work. A line pressure of 350 pounds per square inch was used, which, when acting on the pistons in the rear chuck, developed a clamping force of 7500 pounds on each jaw. An adjustable oil pressure regulator was incorporated in the front chuck. This automatically regulated the force of the jaws to a value just sufficient to accurately support and center the work without distorting it, thus meeting all the requirements of the chucking problem. This new chucking system also promises to contribute a valuable addition to the available methods of holding parts for machining operations.

Other novelties in turret lathe equipment were required to perform the singular duties of these machines. For example, each machine was supplied with a special chain hoist mounted on a boom at the head end of the machine. This hoist was placed adjacent to the chuck, in order to facilitate the changing of the massive tools in the turret. A coolant sump was built into the floor under each machine, and chip chutes leading directly through the bed into hoppers underneath were provided to facilitate the removal of chips. Special operating levers and links were included, as shown in the illustrations, to permit controlling all of the functions of the machine from one position.

So many uncommon features naturally necessitated great care in the construction process. It was necessary, for example, to drill two 1/2-inch holes through 94 inches of solid steel the entire length of the spindle wall. Other parts, such as the huge bearings, the massive spindle, and the chuck parts, which needed to be hydraulically tight, also presented problems of extreme care in handling and machining. An interesting fact, in addition to the extraordinary features of the machines and their inherent accuracy, is that their headstock construction is far more powerful and rigid than that usually employed on even the largest turret lathes heretofore built for heavy-duty work.

"Polaroid," a New "Glass" with Remarkable Properties

A NEW transparent material similar to glass, known as "Polaroid," has been developed by the Land-Wheelwright Laboratories, Inc., Boston, Mass. This new material, which is used the same as glass, "polarizes" light and makes it possible to obtain the most remarkable results. For example, when Polaroid is used in the headlights of automobiles, as well as in the windshield of an approaching car, there is no glare from the fully turned on headlights—in fact, one barely sees them—although all objects in the road are clearly in view. In a demonstration, for example, the numerals on the license plate could be easily read, even though the headlights were directly above the plate.

By the use of this new glass it is possible to produce three-dimensional movies. When used in connection with color photography, the actors virtually come to life, moving no longer merely across a screen, but apparently on a stage for which the outline of the screen seems to form a frame. To get this effect, the pictures must be viewed through spectacles provided with Polaroid. By this means, colors become realistic and objects stand out as if they were actually placed on a stage.

In engineering, this new polarized glass has an important function. It enables models made from transparent materials, such as synthetic plastics, to be used to examine the stresses in engineering structures, or, in fact, in all kinds of industrial products. Furthermore, products transparent in themselves, like glassware, when viewed through Polaroid, will portray strains left by the manufacturing processes through the brilliant colors that the strained portions assume.

Colorless cellophane may be given brilliant colors of every hue for display signs, stage decoration, architectural ornaments, and other purposes, simply by placing clear colorless cellophane between two sheets of the new material. By rotating one of the Polaroid plates, the colors are made to constantly change. Colorless sun glasses made of Polaroid will cut out the glare of the sun, leaving the view unchanged. It is expected that the new material will find many additional applications in science, industry, and even in the everyday walks of life. The application to automobile headlights will probably be its first practical use.

* * *

Wrought-Iron and Wrought-Steel Pipes and Fittings

The Division of Simplified Practice of the National Bureau of Standards, Washington, D. C., has issued Simplified Practice Recommendation R57-32 which covers wrought-iron and wrought-steel pipe, valves, and fittings. These recommendations have been approved by a standing committee of the industry. They cover the nominal inside diameter, outside diameter, and approximate thickness for standard weight, extra strong, and double extra strong wrought-iron and wrought-steel pipe, as originally proposed in 1926 and revised in 1932. Copies of the recommendation can be obtained from the Superintendent of Documents, Government Printing Office, Washington, D. C., at 5 cents each.

Replacement of Machine Tools in Navy Yards

The Average Age of the Machine Tool Equipment in the Navy Yards is Nineteen Years. A Replacement Program of Considerable Magnitude will have to be Vigorously Pursued if this Equipment is to be Brought Up to Date

By Lieutenant Commander R. J. WALKER
Navy Department, Washington, D. C.

AFTER the World War, the U. S. Navy Yards were well equipped for handling the repairs and upkeep of the fleet. This condition was brought about by large war-time expenditures for machine tools. From 1921 to 1925, the War Department bettered this condition by turning over much surplus equipment to the Navy Yards.

From 1925 to 1930, practically no money was appropriated or spent for new equipment in the Navy's Shore Establishments. As a result, the operation of the old and obsolete tools in the yards, in comparison to those in commercial use, became so noticeable that the Assistant Secretary of the Navy's Office realized that steps had to be taken to keep down mounting labor costs due to working with slow and inaccurate machinery.

In connection with accuracy, it might be well to state that men-of-war now require fire control gear that can point one or all of the major guns on a ship and fire them at the same instant from various stations. The same applies to the secondary or smaller guns. These guns have to be so accurately laid that their shell will fall on a small target ten, fifteen, or more miles away.

Early in 1930, an inspection of the Continental Navy Yards was ordered. The outcome was that Congress decided upon a replacement program of $1,500,000 per year for five years for machine tools, with the understanding that at or before the end of the five-year period a resurvey would be made to ascertain continuing needs.

The curves in Fig. 1 show how the depression and subsequent curtailment of government expenditures affected the five-year program. In fact, in 1933 practically no money was spent. The new heavy shipbuilding program with its demands for machine tools resulted in appreciable sums being spent in 1934 and 1935, and appropriated for 1936.

However, even with the expenditures during recent years, the amounts have not been great enough to reduce the average age of machine tools in our yards. This fact is clearly shown by the two curves in Fig. 2 which continue to separate. Until increasing amounts are ap-

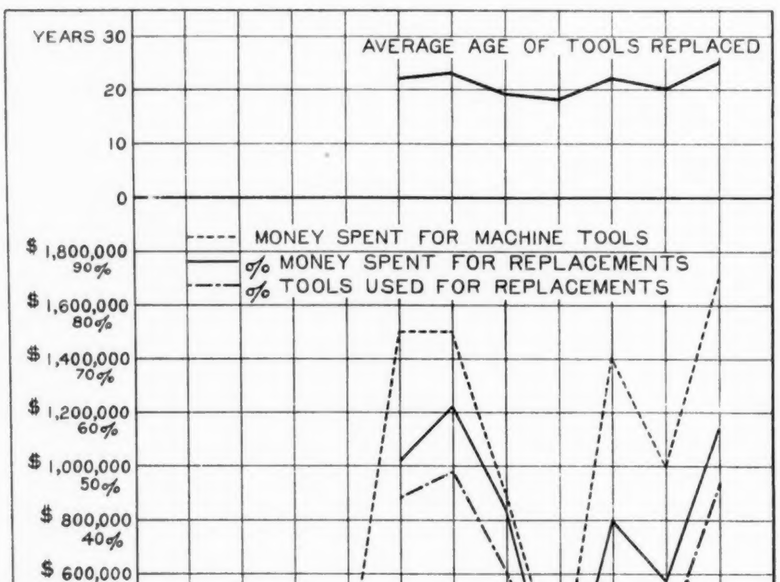


Fig. 1. Curves Showing Average Age of Machine Tools Replaced and Effect on Machine Tool Buying for the Navy Yards of the Depression and Subsequent Curtailment of Government Expenditures

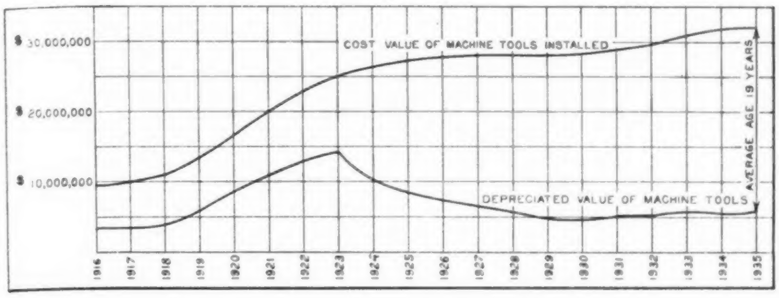


Fig. 2. Chart Indicating How the Average Age of Machine Tools in the Navy Yards has Increased in Recent Years

propriated, these two curves cannot come together, and the already too great average age of tools will not be reduced.

Good commercial practice calls for a 10 per cent yearly replacement of machine tools in general. Such a program results in equipment having an average age of five years. Today the average age of machine tools in our Navy Yards is nineteen years, nearly four times as great. To reduce this, a yearly sum of money for replacements will have to be spent depending upon the average age desired, as shown in Fig. 3. In this diagram, it will be noted that the average age increases rapidly as the amount set aside for annual replacements decreases.

The formula on which the curve is based is

$$2XY = 37{,}000{,}000 \text{ dollars,}$$

in which X is the amount, in dollars, spent annually for replacement, and Y the average age of the equipment when replaced.

The total replacement value ($37,000,000) is assumed to remain constant. A recommendation of $2,500,000 per year for five years was recently made by the Navy Department after a survey of the Continental Yards. Such a sum, if spent indefinitely, would bring the average age down to seven and one-half years. However, if such a sum should be spent annually, at the end of five years another inspection of the yards should be made to substantiate future requests for appropriations.

In examining Fig. 2, the question may arise as to why the sudden break in the depreciated value curve. The change of direction was caused by the accounting department of the Navy shifting from earlier depreciation tables to a new table in which the scrap value is nil at the end of the estimated life of a machine.

At the top of Fig. 1 may be seen a curve of the average age of tools replaced from 1930 to 1936. The curve below showing the percentage of the money each year which went for replacements is most interesting. In other words, what set out to be a replacement program had to be diverted to buying entirely new types of equipment, caused by the changing art of working metals. Nearly a million dollars has been spent in welding equipment alone during the last five years. Before that time, riveting and bolting were the means of securing plates and frames together.

Last year a request was made to the Federal Relief Administration to set up a project for the purchase of $24,663,880 worth of machine tools to rehabilitate the various Naval Shore Stations. Had such a sum been appropriated, the average age of equipment ashore could have been reduced from nineteen years to approximately ten years. Much of the old and obsolete equipment which is so costly and slow to operate, to say nothing of its inaccuracy, could have been replaced. Unfortunately, this sum was never approved, probably because the cost per man per year for building machine tools was considered too high. Cost figures based on F.E.R.A. instructions amounted to $21,943 per man per year, the high value of this figure being due to the fact that "installation charges" were the only charges allowed to apply toward employment; those based on Department of Commerce statistics were $1720 per man per year. Neither of these was low enough to come under the $1370 per man per year to give 3,500,000 men employment with the $4,800,000,000 appropriated for relief by Congress.

With our Navy Yards working to capacity, it will be interesting to see what this Congress will appropriate for machine tools. There can be little doubt that this is a most important project.

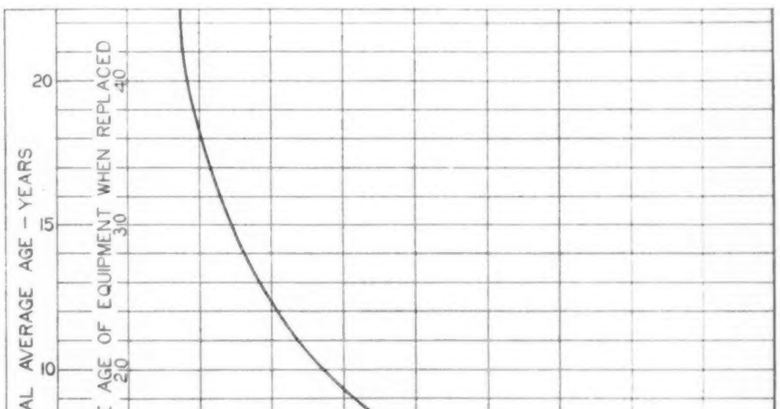


Fig. 3. Curve Showing Relation between Amount Spent Annually for Replacement and the Average Age of Navy Yard Machine Tools

Engineering News Flashes

The World Over

Drawn Tubing 0.009 Inch in Diameter

Cold-drawn seamless tubing, usually thought of as being made in fairly large-diameter sizes, is now produced commercially in such diminutive dimensions that it can literally be threaded through the eye of a needle. The Summerill Tubing Co., Bridgeport, Pa., regularly produces such tubing with an outside diameter of 0.012 inch—about four times that of human hair—and 0.0015 inch in wall thickness. On special order, the company has produced tubing as small as 0.009 inch outside diameter. Such tubing finds its chief application in hypodermic needles. On tubing of this size, exceptionally close tolerances must prevail. On the diameter, the tubing is made within plus or minus 0.0005 inch; the wall thickness is made within limits of plus or minus 0.00025 inch. From fifteen to twenty drawing operations are required to bring down to these small diameters the 1/2-inch diameter cold-rolled tubing stock used for producing the tubes. Annealing is required between each draw.

A Mammoth Electromagnet

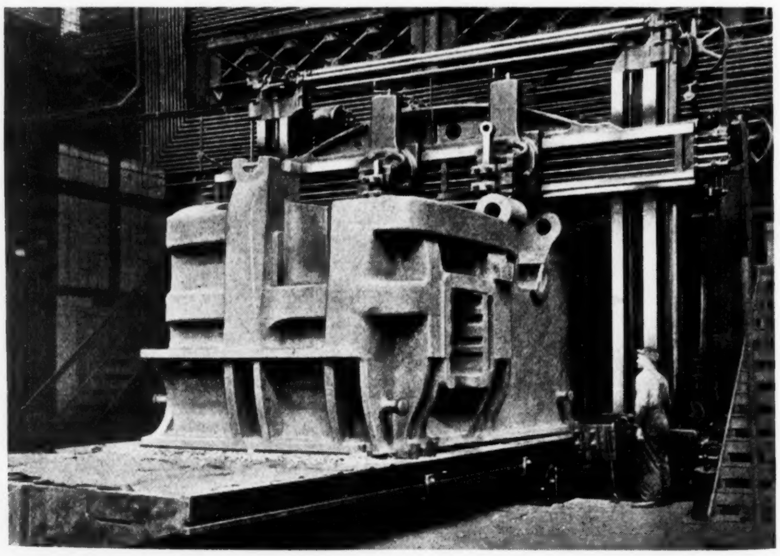
According to information obtained from abroad, the laboratories of the University of Upsala, Sweden, have recently installed an electromagnet having a force of attraction between the poles of 60 tons. The magnet fully assembled weighs 37 tons. The housing, which is of the cylindrical type, has an outside diameter of about 5 1/2 feet and is approximately 7 feet long. The magnet is so mounted that it can be turned on an axis in either the vertical or horizontal plane.

Modern Methods for Rolling Thin Flat Stock

In the most recently developed process for rolling thin flat stock, heated steel slabs from 3 to 6 inches thick are first rolled at high speed in a heavy continuous hot mill to strip, usually less than 0.11 inch thick, which is coiled as it leaves the mill while still hot. Delivery speeds up to 2000 feet per minute are incorporated in hot strip mills now under construction.

After being pickled to remove the oxide formed during rolling, the coils of hot-rolled strip, several hundred feet long, are reduced to sheet or tin-plate thicknesses by cold-rolling at speeds ranging from 500 to 1200 feet per minute. The finished coil, 5000 to 10,000 feet long, annealed or normalized, is cut to desired lengths by automatic shears, ready for shipment or further processing such as galvanizing or tinning.

A modern hot strip mill usually consists of ten main roll stands arranged in tandem. The stands are driven by motors of from 2500 to 5000 horse-



This huge casting is being machined on a 14-foot planer in the plant of the Allis-Chalmers Mfg. Co., Milwaukee, Wis. It is a steel casting for the bed of a forging machine and weighs 76 tons. The extreme length of the casting is 17 feet; it is 11 feet wide, and has a height of 9 1/2 feet.

power capacity. Power for the finishing train is supplied by two or more synchronous motor-generators of 4000 to 6000 kilowatts capacity each.

A mill of this type is being installed by the Youngstown Sheet & Tube Co. It occupies a building 1000 feet long and 100 feet wide. About once every minute a steel slab several tons in weight passes in a straight line through the mill. According to the Westinghouse Electric & Mfg. Co., the electrical input to the motor room will rise with the passing of each piece of steel through the mill from a few thousand kilowatts to a peak of from 15,000 to 30,000 kilowatts, depending on the width of the finished strip.

Detecting One Part in a Hundred Million

As infinitesimal an amount as one part of mercury vapor in a hundred million parts of air by volume can be detected and registered by a device developed by the General Electric Co., Schenectady, N. Y. Since mercury is used in many industries, it is important to have a means by which mercury vapor in the air can be kept at a minimum. With the new device, the vapor is detected by means of selenium sulphide, a light yellowish compound, which turns brown by exposure to the vapor. Knowing how long the selenium-treated paper has been exposed and determining the intensity of the brown color by comparison with a chart, the concentration of the mercury vapor can be quickly determined.

Aluminum Pistons Sprayed with Cast Iron

A novel application of metal spraying was exhibited at the recent Commercial Motor Show at Olympia by Barimar, Ltd., of London, England. A number of aluminum pistons were built up where worn by being sprayed with cast iron. The advantages of cast iron and aluminum pistons were thereby combined. Pistons were exhibited that were built up at a cost much less than that of a new piston. It is believed that the process may acquire considerable importance in the metal spraying field.

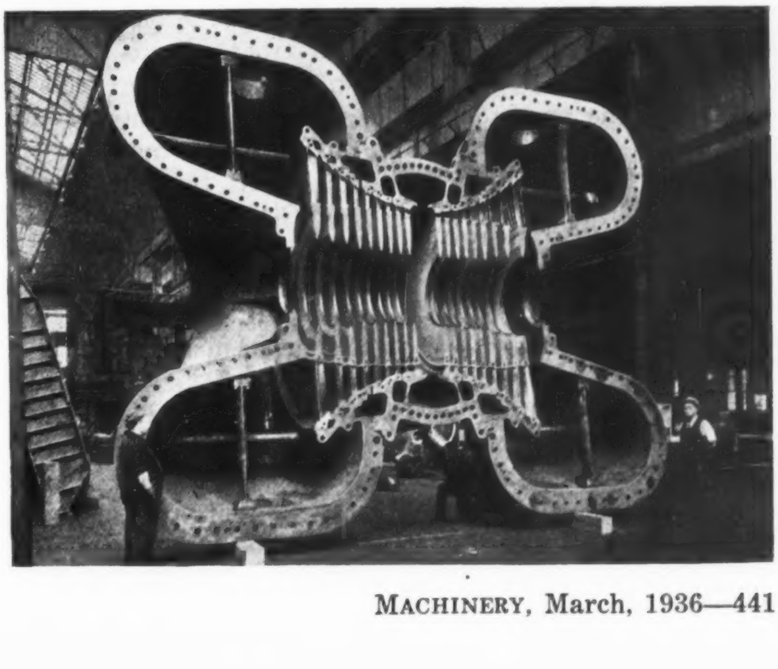
New Process Produces Brilliant Zinc Plating

A new process of zinc plating known as the "Mazic" process has been developed by the Hanson-Van Winkle-Munning Co. of Matawan, N. J. This method permits of making heavy zinc deposits from a cyanide solution, giving satisfactory results in still tank, semi-automatic, and full-automatic plating systems. Mazic anodes made from an alloy developed by the company are used. The Mazic solution is kept in tanks of unlined steel. The solutions are easily maintained, and the high cathode current density permissible with it makes for a high-speed plating bath. The plate is very bright and is said to compare with the best cadmium finish.

10,000 Diesel Engines for Tractors

Late last year the Caterpillar Tractor Co., Peoria, Ill., completed its ten-thousandth Diesel engined tractor. It is four years ago since the company began the building of tractors with Diesel engines and only about two years ago since these began to be built on a real production basis. Approximately five thousand of these tractors were built last year. The ten thousand engines represent 640,000 Diesel horsepower. In the year 1934, these tractor engines represented almost one-third of the 750,000 Diesel horsepower manufactured in the United States. Apparently, it is safe to say that, for tractor purposes, the Diesel engine is here to stay.

The top half of the low-pressure steam-turbine casing and exhaust hood of a 110,000-K.W. turbine-generator for the River Rouge Power Station of the Ford Motor Co., being constructed at the General Electric Co.'s Plant. This turbine uses steam at 1200 pounds pressure and 900 degrees F.



EDITORIAL COMMENT

Designers Must Design to Please Users Rather than Themselves

Years ago a well-known automobile manufacturer, commenting on the many different makes of high-priced automobiles being built at that time, said: "We have so many high-priced cars competing for a small market because every manufacturer likes to build a car of just the type that he himself likes to ride in. He is considering his own preferences rather than his market."

The machine designer often finds himself in a somewhat similar position. His tendency may be to design a machine that will please himself; sometimes what pleases the designer is not the best for the market. He must overcome the desire to find out just how ingeniously he is able to design a machine, and make it his chief aim to find out how he can design the most useful machine at a minimum price.

Simplicity, accessibility, accuracy, and high-grade materials—these are the things most machine users require rather than extreme ingenuity in design. Furthermore, the best machine in the long run is the machine that requires the least "service." If the machine is right in the first place, it will need less service. A few cents here and there added to the first cost of the machine may save dollars later in servicing it.

The Trend is Toward Lower Working Height in Machine Tools

The working height of machine tools is an important consideration in their operation. The wooden platforms so often seen in front of machines are provided partly, at least, for the purpose of placing the operator at the proper height in relation to the machine. At the recent Cleveland Exposition it was evident that there is a tendency to reduce the operating or working height of machine tools.

At this exposition it was also evident that in designing the beds of machines many designers considered it of importance to provide space for the operator's feet. It is generally agreed that there ought to be no projecting flanges on the base at the front of the machine. In one instance, there was a platform built right on the machine for the operator to stand on. Machine designers are giving more and more attention to matters of this kind and have come to realize that there is more to their job than just producing a machine that will function well mechanically.

Developments Made for Own Use May Find Wide General Application

Frequently important industries develop in a manner wholly unexpected to those responsible for the new departure. Some time ago we had occasion to mention in MACHINERY how a manufacturer of a specialized type of printing presses requiring extremely accurate gears installed a gear-cutting department to supply his own needs; and how, because of the reputation he acquired in the precision gear field, he soon found himself engaged in the commercial gear-cutting business. Among other types of precision gears that this firm supplies are timing gears for airplane engines and gears that on military airplanes synchronize the machine gun fire with the revolutions of the propeller.

Recently, a manufacturer of nationally known weighing scales concluded that a better material than cast iron could be employed for the frames of these scales. Experiments were carried on with a new synthetic plastic material, which resulted in the development of an entirely new enterprise that supplies many times more synthetic plastic products for industrial and decorative purposes in general than are required in the scale business.

Some manufacturers have developed special machines for their own use, and only by chance have come to recognize the fact that these machines, with modifications, could be successfully sold to industry at large. At least one important branch of the machine tool industry had such a beginning.

It is profitable to consider, when developing either machines or materials for the specific needs of one's own business, whether these machines or materials might not be useful throughout industry. Sometimes, indeed, businesses have been built on these secondary developments that have become more important than the original business.

Ingenious Mechanical Movements

Mechanisms Selected by Experienced Machine Designers as Typical Examples Applicable in the Construction of Automatic Machines and Other Devices

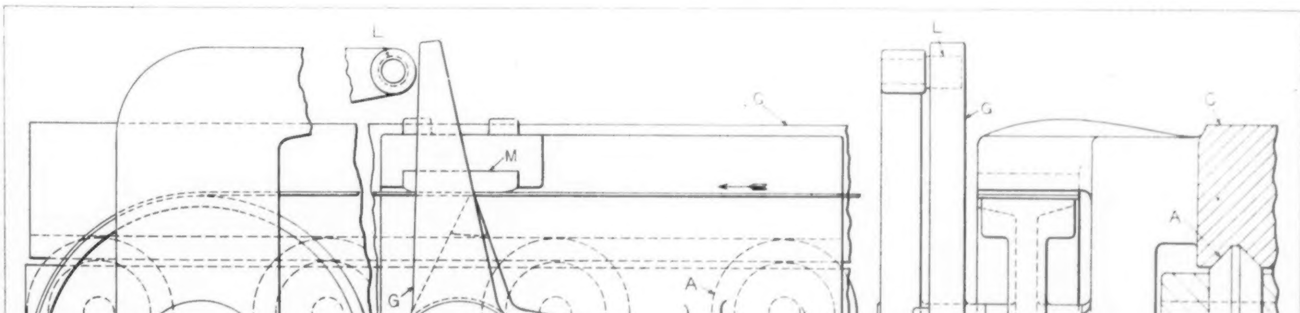
Reciprocating Motion for Table Obtained by Means of a Steel Belt

By J. E. FENNO

The turned shafts used in a certain type of machine tool are finished by polishing with emery cloth. This work is done on a machine in which the shaft is revolved between centers while the emery cloth, in a suitable holder, is held in contact with the shaft and moved back and forth by a reciprocating table. The long reciprocating movement of the table is obtained by alternately engaging and disengaging opposite sides of a horizontal steel belt. The mechanism secured to the table for automatically engaging and disengaging the belt is shown in the illustration.

The reciprocating table *C* is mounted on the beveled rollers *A*. An apron *D*, cast integral with the table, carries the reversing tumbler *E*, the spring-actuated plunger *F* and the dog lever *G*. Tumbler *E* and lever *G* are pinned together, but are free to turn on the stud *H*, secured in the apron. The belt drums are mounted on shafts supported by brackets which are secured to the machine bed. Only the left-hand drum *J* is shown. This is the driving drum which rotates at a constant velocity. The other drum is the idler, and its bracket has a horizontal adjustment for taking up the slack in the steel belt *K*. On an extension on each of the brackets is a pin *L*, which engages the lever *G* at each end of the table stroke, causing the movement of the table to be reversed.

The spring on plunger *F* is made heavy enough to maintain engagement of tumbler *E* when the table is moving toward the right. As shown, the action of plunger *F* causes the top side of the belt to be gripped tightly between the top prong of the tumbler *E* and the block *M* secured to the apron. Consequently, the table must travel in the same direction as the top side of the belt, as indicated by the arrow. At the end of the movement in this direction, the lever *G* engages stationary pin *L* which swings the lever in a clockwise direction,



Mechanism Used on Machine Table to Alternately Engage the Upper and Lower Sides of a Horizontal Belt to Obtain a Reciprocating Motion

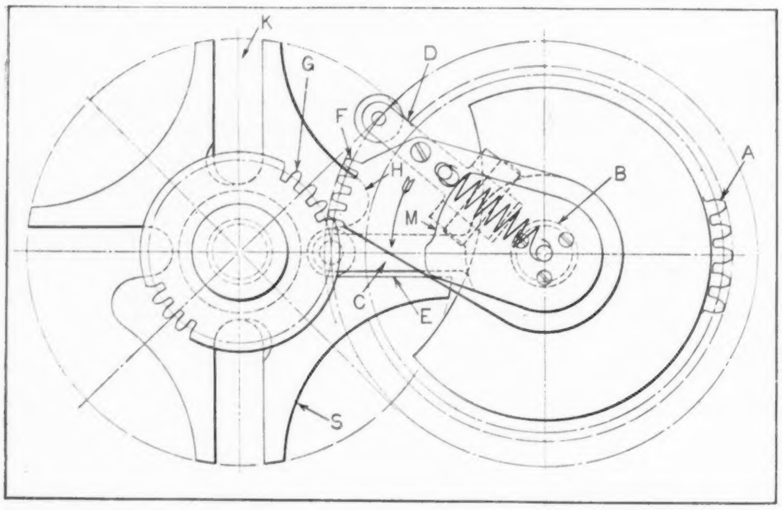


Fig. 1. Intermittent Drive Mechanism Designed to Accelerate and Decelerate Motion at Start and Finish of Driving Movements

thus disengaging the top prong of tumbler *E* from the belt.

Although the belt is then disengaged from the table, the resulting momentum causes the table to continue its motion in the same direction, so that the lower prong of the tumbler engages the lower side of the belt. This causes the belt to be gripped between the lower prong of tumbler *E* and the apron block *N*. As the lower side of the belt is moving toward the right, the movement of the table will be reversed. Wear resulting from use will eventually destroy the gripping action of the prongs and blocks, but this condition can be easily corrected by placing shims under the blocks *M* and *N*.

Combined Geneva and Intermittent Gear Movements

By FREDERICK H. FAIRWEATHER

In order to modify the operating characteristics of the well-known Geneva gear movement to adapt it for a particular purpose, the writer incorporated intermittent gearing in the design, as here illustrated. After laying out the design on the drafting board, a model was made which operated satisfactorily.

As shown in Figs. 1 and 2, the mechanism consists of a modified double driving arm Geneva wheel with intermittent gear segments. The gear segments are so placed that they transmit a practically uniform speed movement to the driven member from the instant the driving arm ends its accelerating movement until the second driving arm begins its decelerating movement in stopping the driven member. One advantage of the mechanism, in its application to an automatic machine, is that the driver requires a movement of only about 130 degrees to rotate the driven member 180 degrees. This leaves 230 degrees of the driver cycle free to perform other useful work or operations while the driven member dwells.

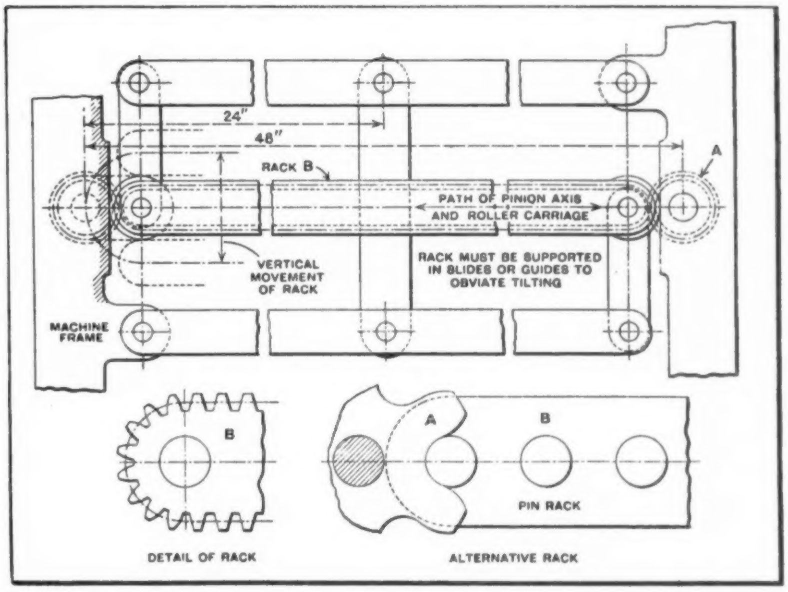
Referring to the illustrations, *A* is the driving gear, which operates at a uniform speed. The whole driving unit is mounted on the stationary stud *B* and rotates in the direction shown by the arrow. The first driving arm *C* is integral with the driving member, while the second arm *D* is pivoted to it and suitably spaced from the first arm.

When arm *C* engages slot *E* in the driven spider *S*, it will start rotation of the latter member and accelerate its speed until arm *C* reaches the center line between the two members. At this point the intermittent gear segment *F* meshes with its mating segment *G* on the driven member. As the pitch line of the intermittent gears corresponds with the center line of the path in which the arm rollers rotate, the gears continue the motion of the driven member at approximately the same speed as was attained by the roller arm *C* at the instant it passed the line between the centers of the driving and driven members. The slot or arm on the far side of the spider *S* is short-

Fig. 2. Mechanism Shown in Fig. 1 with Various Members in Different Operating Positions

ened and so shaped at H that the roller cannot interfere with the uniform motion imparted by the gears as the roller recedes from the slot.

The ratio of the intermittent gears is such that the driven gear G will rotate 90 degrees while the gears are engaged, the remainder of the 180-degree movement being derived from the two driving movements of 45 degrees each, imparted by the accelerating arm C and the decelerating arm D. The latter arm, because of its pivoting feature (see Fig. 2) and the tension of the spring J is held out of engagement with its slot K, as indicated by the dotted lines L, until just before it reaches the center line, when the action of the lobe of the stationary cam M on the pin N forces the arm down into engagement with its slot. This engagement occurs at the instant when the intermittent gears pass out of engagement. The Geneva gear action of the arm D, in its further rotation, decelerates the driven member to a stop 180 degrees from the point where the accelerating arm C started its rotation.



Mechanism for Producing Vertical Reciprocation of Carriage Having Horizontal Forward and Back Movement

Mangle Gear Mechanism for Reciprocating a Machine Carriage

The mechanism shown in the accompanying illustration, used for reciprocating a carriage, is similar to that embodied in a certain type of printing press. The gear or sprocket A, moving with the carriage, passes around a double-edged rack or a rack with pin teeth B. Either the pinion or rack may rise and fall, but only when the pinion is near the ends of the rack. With the system of levers shown in the illustration, the rack is compelled to move bodily as the pinion "rounds" the ends of the rack. B. M.

* * *

Hard-Facing Increases Life of Shear Blades

Glass shear blades used for cutting off the surplus glass from the mold used for making blown water glasses have had their life increased at least ten times by hard-facing. The glass is red-hot and plastic at the time of the cut, so that the blades operate at extremely high temperatures. The blades, hard-faced with cobalt-chromium-tungsten alloy, outlast the hardened steel blades formerly used at least ten times. They have now been employed for seven years, and both tool costs and shut-downs have been greatly reduced through their use. According to the Haynes Stellite Co., only one-tenth of a pound of hard-facing alloy and five minutes welding time are required to give the proper protection to each blade.

The Japanese Machinery Industry

According to information issued by the Department of Commerce, Washington, D. C., the Japanese machinery industry is making notable progress. The production in 1934 was an all-time record, with an increase of approximately 22 per cent over 1933. The output in 1933 showed an increase of 60 per cent over 1932. The machinery production, excluding vehicles and electrical equipment, represents over 30 per cent of Japan's industrial output.

The machinery imports of the country have increased in recent years, along with the domestic production. The total machinery imports in 1934 were valued at approximately \$29,000,000, as compared with \$21,000,000 in 1933. The exports increased from \$7,700,000 in 1933 to \$17,000,000 in 1934. The imports in the first ten months of 1935 were valued at \$26,500,000 and the exports at \$15,500,000. The United States is the leading supplier of industrial machinery to Japan, furnishing imports valued at \$10,500,000 in 1934; furthermore, the imports during the first ten months of 1935 showed an increase over the corresponding period during the preceding year.

* * *

Tool, Die, and Machine Shop Institute

The Hudson River Valley Division of the Special Tool, Die, and Machine Shop Institute, Inc., of which Sidney Diamant, 401 Mulberry St., Newark, N. J., is president, and B. B. Beck, 11 New York Ave., Brooklyn, N. Y., secretary-treasurer, holds regular meetings on the evening of the second Tuesday each month at the Hotel Pennsylvania, New York City. At the meeting on February 11, the subject dealt with was "Drawing Dies." The next meeting will be held on March 10.

Metals Used in Die-Casting

Characteristics of the Alloys in General Use for the Production of Die-Castings

By CHARLES H. HUGHES

ANY metal intended for die-casting purposes must flow readily in the molten state, so that it can be forced under pressure to all sections of the die cavities. In cooling, the metal must form smoothly, so as to prevent as far as possible the necessity of subsequent machining operations.

Alloys of aluminum, copper, lead, magnesium, tin, and zinc can be die-cast successfully. Those with the lowest melting point, such as lead, tin and zinc, are the easiest to cast, because there is less wear and tear on the dies. Good machine steel, not even heat-treated, can be employed for dies used to cast parts from the low-temperature alloys, whereas heat-treated alloy-steel dies are necessary for casting parts from aluminum and copper alloys.

Zinc, aluminum, and copper alloys are the most popular because of their properties. The accompanying tables list the compositions and properties of the most generally used die-casting alloys.

The Advantages of Aluminum-Base Alloys

Aluminum die-casting alloys possess the advantages of comparatively high tensile strength, light weight, resistance to corrosion, and ability to take a good polish and to hold it under normal atmospheric conditions. These advantages adapt them to a wide variety of applications. They are used extensively for parts of vacuum cleaners, household appliances, and cameras; also for motor and instrument housings and for an endless variety of articles in everyday use.

The S.A.E.-304 (A.S.T.M. spec. B85-31 T alloy IV) composition withstands salt-water corrosion especially well, and is, therefore, suitable for aircraft-engine parts and marine fittings. Specification S.A.E.-305 (A.S.T.M. spec. B85-31 T alloy V) is also resistant to salt water. Another very important characteristic of this alloy is its fluidity. This makes it particularly suitable for castings of thin-walled or intricate design. Specification S.A.E.-307 (A.S.T.M. spec. B85-31 T alloy VII) is a general-purpose alloy. Alloy S.A.E.-309 (A.S.-T.M. spec. B85-31 T alloy IX) is particularly suited to the manufacture of die-castings to be polished, since the reduced amount of silicon and the increased nickel give it a whiter appearance than the other aluminum alloys possess. Specification S.A.E.-312 (A.S.T.M. spec. B85-31 T alloy XII) is a low-cost, easily cast alloy which has perhaps been more widely used than any other aluminum alloy for die-casting purposes.

The applications of zinc die-castings seem almost endless. They have proved satisfactory for use on automobiles and machinery, and for ornamental purposes. They have also been used extensively for typewriter frames, carburetors, gasoline pumps, clock cases, washing-machine gears, small motor end-housings, door handles, etc. Zinc castings should not be exposed to high temperatures because of their low melting point, which is about 725 degrees F.

Practically any type of commercial finish can be applied to zinc castings after a light polishing operation. They can be electroplated with chromium, nickel, copper, brass, bronze, gold, and silver, or they can be coated with paints, varnishes, lacquers, and enamels.

Copper-Base Alloys Used Increasingly in the Last Few Years

Copper-base alloys possess superior properties as regards strength, impact value, and elongation, and they are not affected by many chemicals or atmospheric conditions. The impact value of brass die-castings is greater than that of sand castings of the same alloy and nearly equal to that of forgings.

The Doehler Die Casting Co. produces a copper-silicon-zinc alloy known as "Brastil" which has a strength equivalent to that of medium carbon steel. It can be accurately cast into intricate shapes. Brastil has been used for cams, automobile-door strikers, tie-rod brackets, etc.

Manganese-bronze is widely used for such articles as window and casement fastenings, handles, levers, hardware, marine fittings, and valve parts.

The Doehler Die Casting Co. has recently developed another copper-silicon-zinc alloy known as "Doler-Brass" which is intended for general use in brass die-casting when the superior strength of Brastil or the appearance of white nickel brass is not required. In other words, it is intended for the same variety of applications as manganese-bronze. However, it has an elongation of from 20 to 25 per cent in 2 inches and a Brinell hardness of between 110 and 120. The tensile strength is from 65,000 to 75,000 pounds per square inch, and the yield point is from 30,000 to 40,000 pounds per square inch. Doler-Brass is light yellow in color.

Aluminum-bronze S.A.E.-68 has the same tensile strength as medium carbon steel and possesses the further advantage of not being acted upon by water, brine, and other liquids. Among its applications may be mentioned conveyor-chain

links, swivel brackets for outboard motors, washing-machine parts, bearing hubs, and ratchet wheels. White nickel brass S.A.E.-42 makes a satisfactory base for nickel plating, because if the plating should become worn, the whiteness of the metal base will minimize the worn appearance.

Lead-base alloys find wide application because of the resistance they offer to many chemicals.

Compositions of Die-Casting Alloys, in Per Cent

Alloy	Copper	Iron	Silicon	Impurities	Aluminum	Magnesium	Lead	Cadmium	Tin	Zinc	Manganese	Nickel	Antimony	Arsenic	Bismuth
Aluminum A. S. T. M. 4–S. A. E. 304	0.6	2	4.5 to 6	0.2	Balance	0.1	—	—	0.1	0.75	0.3	0.5	—	—	—
Aluminum A. S. T. M. 5–S. A. E. 305	0.6	2	11 to 13	0.2	Balance	0.1	—	—	0.1	0.75	0.3	0.5	—	—	—
Aluminum A. S. T. M. 7–S. A. E. 307	3.5 to 4.5	2.25	4.5 to 5.5	0.2	Balance	0.1	—	—	0.1	0.75	0.3	0.5	—	—	—
Aluminum A. S. T. M. 9–S. A. E. 309	3.5 to 4.5	2.5	1.0 to 2.5	0.2	Balance	0.1	—	—	0.1	0.75	0.3	3.5 to 4.5	—	—	—
Aluminum A. S. T. M. 12–S. A. E. 312	7 to 9	2.5	1 to 2	0.2	Balance	0.1	—	—	0.1	1.0	0.3	0.5	—	—	—
Zinc–A.S.T.M. No. 21 S. A. E. 921	2.5 to 3.5	0.1	—	—	3.5 to 4.5	0.02 to 0.12	0.007	0.005	0.005	Balance	—	—	—	—	—
Zinc–A. S. T. M. No. 23 S. A. E. 903	0.10	0.1	—	—	3.5 to 4.5	0.03 to 0.08	0.007	0.005	0.005	Balance	—	—	—	—	—
Zinc–Zamak No. 2*	2.70	—	—	—	4.10	0.03	—	—	—	Balance	—	—	—	—	—
Zinc–Zamak No. 3*	—	—	—	—	4.10	0.04	—	—	—	Balance	—	—	—	—	—
Zinc–Zamak No. 5*	1	—	—	—	4.10	0.03	—	—	—	Balance	—	—	—	—	—
Zinc–Zamak No. 6*	1.25	—	—	—	4.10	—	—	—	—	Balance	—	—	—	—	—
Manganese-Bronze A. S. T. M. B.-54-27 S. A. E. 43	57 to 59	—	—	—	0.10	—	0.75	—	0.5 to 1.50	40 to 42	0.25	—	—	—	—
Copper-Zinc-Silicon (Brastil)†	80 to 81	—	4.5 to 5.0	—	—	—	—	—	—	Balance	—	—	—	—	—
Aluminum-Bronze S. A. E. 68	85 to 87	—	—	—	7 to 9	—	—	—	—	—	—	2.5 to 4.5	—	—	—
White Nickel Brass S. A. E. 42	55 to 64	0.35	—	0.25	—	—	—	—	—	Balance	—	18	—	—	—
Tinicosil No. 20‡	42	—	—	—	—	—	1	—	—	41	—	16	—	—	—
Lead-Antimony	—	—	—	—	—	—	90	—	—	—	—	—	10	—	—
Lead-Antimony-Tin	—	—	—	—	—	—	80	—	5	—	—	—	15	—	—
Lead–S. A. E. 13	0.50	—	—	—	—	—	86	—	4.5 to 5.5	—	—	—	9.25 to 10.75	0.20	—
Lead–S. A. E. 14	0.50	—	—	—	—	—	76	—	9.25 to 10.75	—	—	—	14 to 16	0.20	—
Magnesium§	—	—	—	—	10	Balance	—	—	—	—	0.10	—	—	—	—
Magnesium¶	—	—	0.5	0.3	7 to 9	Balance	—	—	—	0.3	0.15	—	—	—	—
Tin–S. A. E. 10	4 to 5	0.08	—	—	—	—	0.35	—	90	—	—	—	4 to 5	0.10	0.08
Tin–S. A. E. 11	5 to 6.5	0.08	—	—	—	—	0.35	—	86	—	—	—	6 to 7.5	0.10	0.08
Tin–S. A. E. 12	2.25 to 3.75	0.08	—	—	—	—	26	—	59.5	—	—	—	9.5 to 11.5	—	0.08

*Product of the New Jersey Zinc Co. †Product of the Doehler Die Casting Co. ‡Product of the Titan Metal Mfg. Co. §Dowmetal G of the Dow Chemical Co. and AM 240 of the American Magnesium Corporation. ¶Alloy 241 of the American Magnesium Corporation.

They are also extensively used for bearing purposes, toys, and novelties. They are naturally not adapted for stressed machine parts, because of their low strength. Neither are they suitable for parts that are to handle food products, because of the poisonous lead compounds likely to be formed.

The hardness of lead-base alloys can be increased by adding to the antimony content. Tin improves the strength and the fluidity.

Lightness is the Outstanding Feature of Magnesium-Base Alloys

Magnesium-base alloys are about two-thirds as heavy as aluminum and approximately one-fifth as heavy as brass. The Dow Chemical Co., Midland, Mich., produces an alloy designated "G," which is especially suitable for die-casting purposes. Typical applications of alloy G are small tool handles and parts for airplanes, typewriters, and adding machines.

Tin-Base Alloys are Used for Food-Handling Articles and Bearings

Tin lends itself well to die-casting because of its low melting point; but as its cost is high, the cheaper low-melting metals are generally selected, unless resistance to certain liquids is essential. Thus, tin-base alloys are used for die-casting syrup cups, soda-fountain appliances, milking-machine parts, and other articles that must be immune to

Properties of Die-Casting Alloys

Alloy	Tensile Strength, Pounds Per Square Inch	Impact Strength (Charpy) Foot-pounds	Brinell Hardness Number	Elongation, Per Cent	Melting Point, Degrees F., Approximately
Aluminum—A. S. T. M. 4—S. A. E. 304..	29,000	4.5	—	3.5	1100
Aluminum—A. S. T. M. 5—S. A. E. 305..	33,000	2	80	1.5	1110
Aluminum—A. S. T. M. 7—S. A. E. 307..	32,000	2.5	—	2	1090
Aluminum—A. S. T. M. 9—S. A. E. 309..	31,000	2	—	1.5	1150
Aluminum—A. S. T. M. 12—S. A. E. 312	33,000	1.5	70	1	1090
Zinc—A. S. T. M. No. 21—S. A. E. 921..	44,000	6	—	2	—
Zinc—A. S. T. M. No. 23—S. A. E. 903..	35,000	12	—	3	—
Zinc—Zamak No. 2*	47,900	19	83	5.1	715
Zinc—Zamak No. 3*	40,300	20	74	4.7	715
Zinc—Zamak No. 5*	44,500	17	76	3	715
Zinc—Zamak No. 6*	43,000	22	74	4.9	715
Manganese-Bronze—A. S. T. M. B-54-27—S. A. E. 43	60,000 to 70,000	40	110 to 130	10 to 15	1650
Copper-Zinc-Silicon (Brastil)†	85,000 to 90,000	Over 36	160 to 180	8 to 15	1600
Aluminum-Bronze—S. A. E. 68	72,000 to 80,000	—	—	25 to 30	1900
White Nickel Brass—S. A. E. 42	50,000 to 60,000	40	110 to 115	10 to 15	—
Tinicosil No. 20‡	85,000 to 95,000	—	160	10 to 20	1675
Lead-Antimony	7,700	—	15.5	15.5	—
Lead-Antimony-Tin	9,100	—	23.2	3.8	—
Lead—S. A. E. 13	13,800	0.4 to 0.6 (Izod)	23	10.5	—
Lead—S. A. E. 14	12,500	0.4 to 0.6 (Izod)	24	2	—
Magnesium§	26,000 to 30,000 (Low-pressure casting) 29,000 to 33,000 (High-pressure casting)	1 to 3 1 to 2	60 to 70 60 to 70	1 to 3	—
Magnesium¶	28,000	—	53	2.5	—
Tin—S. A. E. 10	9,000	—	25 to 30	2	420
Tin—S. A. E. 11	10,000	—	30 to 35	1	420
Tin—S. A. E. 12	7,800	—	27 to 32	1.25	450

*Product of the New Jersey Zinc Co. †Product of the Doehler Die Casting Co. ‡Product of the Titan Metal Mfg. Co. §Dowmetal G of the Dow Chemical Co. and AM 240 of the American Magnesium Corporation. ¶Alloy 241 of the American Magnesium Corporation.

the action of acids from foods and food products or to alkalies. When tin die-castings are to be used for such purposes, the copper and lead content must not be enough to form poisonous compounds with the liquids handled.

Tin alloys have only a small shrinkage in cooling, and so they are particularly desirable when accuracy is essential in castings. Tin-base alloys are not adapted for highly stressed machine parts, but they do possess valuable bearing properties.

* * *

Piston Anodizing Tank with Cooling and Ventilating Systems

The equipment developed for anodizing alloy pistons at the plant of the Buick Motor Car Co., Flint, Mich., has made possible automatic operation and close control over this process, which changes the surface metal to a hard oxide having long wearing qualities. The anodizing tank shown in the accompanying illustration is a particularly interesting unit of the equipment.

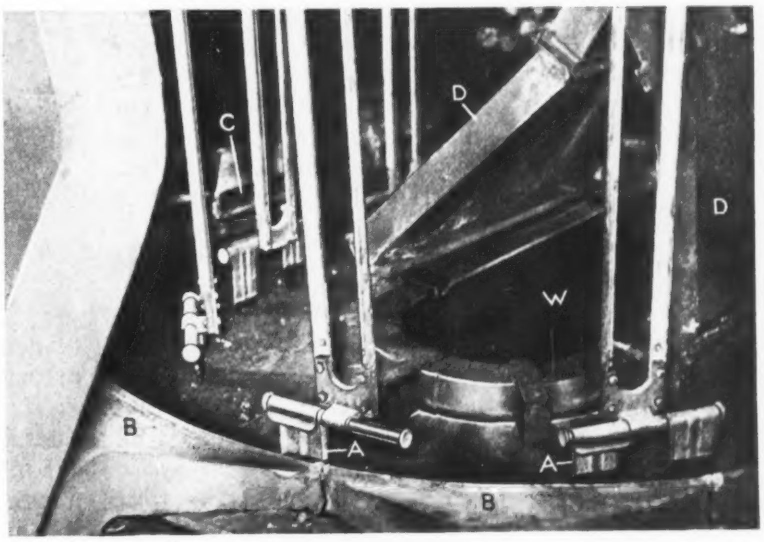
Before coming to this tank, the pistons are hung on specially designed racks with which they make electrical contact. These racks are lifted by an overhead conveyor and deposited in the first bath containing a chemical cleaner. After a definite period in this bath, they are picked up by another conveyor, lifted out, and deposited in a water rinse tank. From here they are removed by a third continuously running conveyor and transferred to the anodizing bath in the tank shown in the illustration.

The latter tank is U-shaped. The racks *A* carrying the submerged pistons gradually move around the U-shaped tank during a fifteen-minute cycle. At the end of this cycle or travel around the tank, the pistons are automatically lifted out and deposited in a cold water rinse, which is followed by a hot water rinse.

The racks *A* from which the pistons have been removed continue on into another bath in which the current is the reverse of that in the anodizing bath. The reversed current serves to remove all traces of oxide from the rack. This is necessary, as the oxide is a non-conductor and would prevent electrical contact with the pistons.

The ventilator ducts which carry away any gases that might be liberated from the anodizing bath are of especial interest. The ducts *B*, with openings as shown at *C*, surround the outer edge of the tank just above the surface of the bath. Ducts *D* on the inner side of this tank also have their openings just above the surface of the bath. This efficient ventilating system serves to maintain good working conditions.

Another interesting feature of the anodizing tank is the cold water cooling tank inside the U-shaped tank. The water *W* in this tank is taken from a well 354 feet deep, which was sunk for this purpose. This water cools the anodizing bath by means of conduction through the separating walls. By the aid of pyrometers in the bath and control of the water flow in the cooling tank, the temperature is automatically held to ± 1 degree F.



Anodizing Tank Developed for Treatment of Buick Pistons

* * *

Soviet Purchases in the United States

The purchases of the Soviet Union in the United States in 1935 amounted to $42,000,000, almost three times the purchases in 1934. Most of this volume of business was done through the Amtorg Trading Corporation, which placed orders with eight hundred American firms during the year, fifty of whom received orders ranging in amounts of from $100,000 to $3,000,000. Industrial equipment accounted for $27,200,000 of the total. This included machine tools especially for the automobile and tractor factories in the Soviet Union, rolling mill equipment, oil refining equipment, and automobile body stamping dies. These purchases were the largest in several years.

* * *

Industrial Shows During 1936

A comprehensive list of all the important trade, industrial, and professional exhibitions to be held in 1936 has been compiled by the Exhibitors Advisory Council, Inc., 330 W. 42nd St., New York City. Approximately 250 shows, covering practically all industries and trades, are listed. Copies of this show listing are obtainable from the Exhibitors Advisory Council at $3 a copy.

Dies for Making Flanged Rectangular Parts from Strip Stock

By H. THORNTON

THE bending of sheet-metal strip stock is ordinarily a simple operation, provided the stock is bent flatwise and not edgewise. To bend flat stock edgewise is a much more difficult problem. This is equally true whether the material is light sheet stock or bar stock of heavy cross-section. The forming of the outside edge of the flanges on the part shown in Fig. 1 is more a matter of stretching the metal than bending, and for this reason, a ductile material is required in order to prevent rupturing the metal while it is being formed.

The part illustrated is a brass shield for an electrical device. These formed pieces are assembled in pairs in a certain type of electric meter, the slotted ends receiving the terminal screws. The pieces are channeled and beaded at *B* to give maximum strength with minimum weight. The round-corner bends of the original design shown at *A* have been modified, as indicated at *C*. Each of the dies used in the production of this piece have some unique means for performing certain functions.

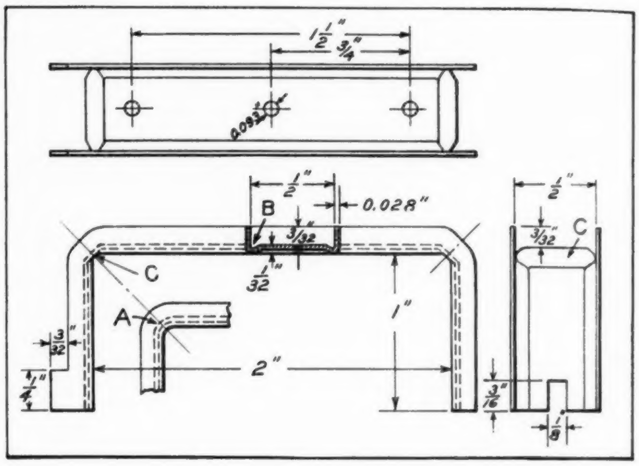


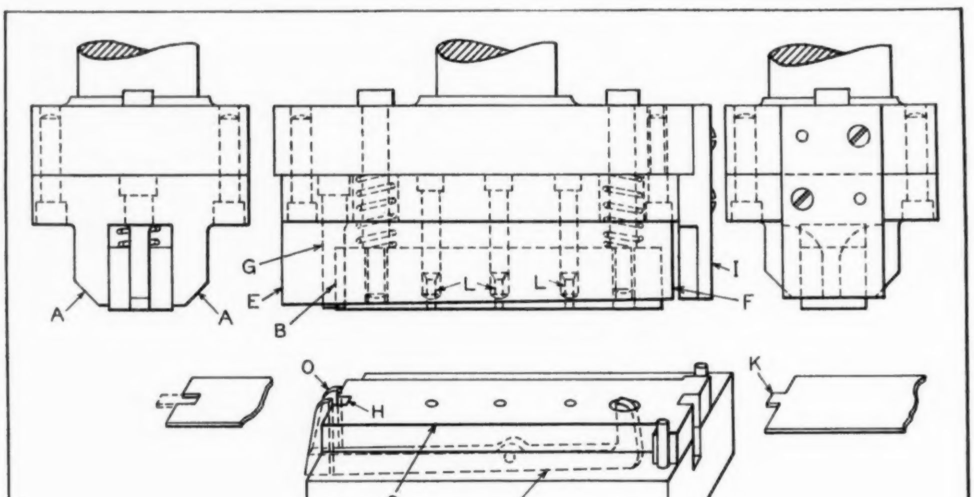
Fig. 1. Brass Shield for Electrical Device Formed from Strip Stock by Dies Shown in Figs. 2, 3, and 4

Blanking Die with Side-Shearing Blades

The upper part of the blanking die, Fig. 2, comprises the shearing member with the two shearing blades *A*, which are grooved to receive the spring pressure pad *B*; the punch *G* which cuts the slot at *H*; and the punch *I* for cutting off the stock so that a tongue *K* is left on the stock and a slot is cut in the blank. The tongue *K* is removed by the punch *G* when the blank is cut off. This double-shear member is designed to straddle the die *C*, so that it will shear the edges of the stock. The blades *A* are ground with a slight rake from *E* to *F*. It will be noted that the punch *I* cuts the piece to length without waste, leaving the tongue *K* on the end of the stock.

The face of the die, or lower member, corresponds to the pierced and sheared blank. The small punches *L* pierce the blank, thus providing holes for locating means in the subsequent operations. The means for centering and gaging the stock to length for blanking is shown in the lower view, Fig. 2. This consists of a lever *M*, one end of which extends upward through a hole in the face of the die. This end of the lever

Fig. 2. Die for Shearing, Piercing, and Cutting off Blank for Part Illustrated in Fig. 1



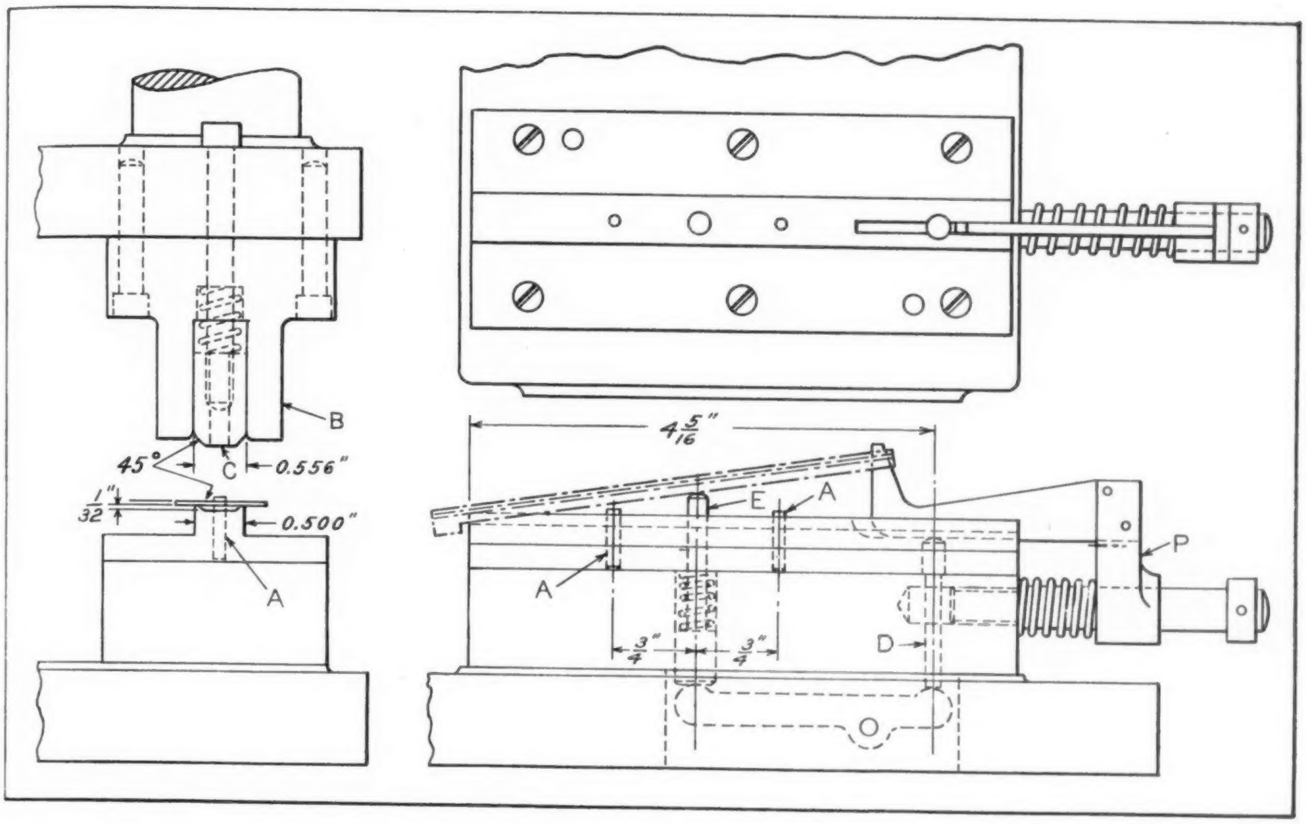
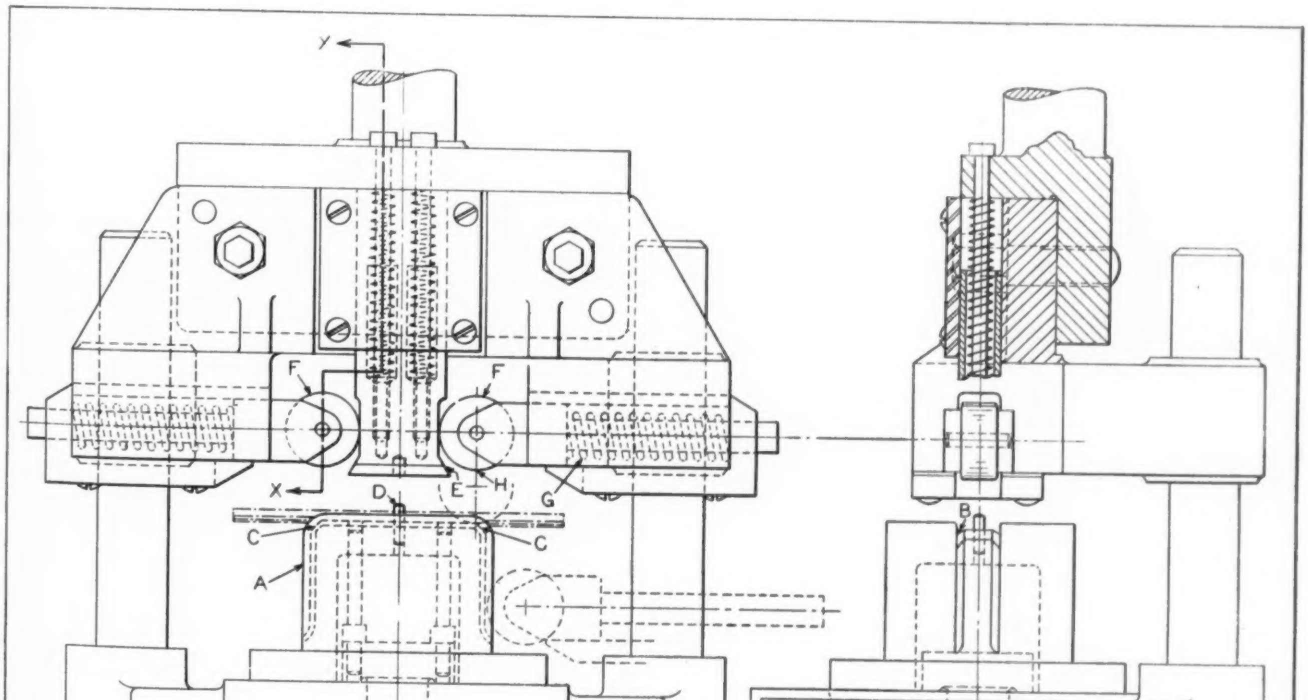


Fig. 3. Die Employed for Forming the Bead and Flanges of Channel-shaped Part

Fig. 4. Bending and Forming Die that Completes Operations on Part Shown in Fig. 1



is depressed in feeding the stock inward so that the opposite end O is raised to serve as a gage or stop. The gaging end at O is designed to receive and center the tongue K of the strip and to straddle the punch G.

Design of Beading and Flange-Forming Die and Bending and Forming Die

The upper member of the beading and flange- or channel-forming die, Fig. 3, is similar to that of the die shown in Fig. 2. The blank is located by means of the pins A. The pressure-pad C is beveled to agree with the die below, so as to form the bead B, Fig. 1. The form punch B, Fig. 3, follows the pressure-pad and bends the flanges down, while the pressure-pad holds the work in the recess in the die. The finished piece is ejected by the pusher P. The pusher depresses the pin D and raises the plunger E during the first portion of its inward movement, and during the latter part of its stroke pushes the work from the die.

The bending and forming die, Fig 4, has the bending die-block A channeled as shown. The channel is recessed at B to receive the bead on the part. The corners of the die-block are beveled at C and the part is located laterally on pin D. The operation of the tool is such that as the upper member descends, the foot E of the pressure-pad acts on the rollers F, compressing the springs G just as the roller point H makes contact with the work at the bevel point of the die-block. As the upper member continues to descend, the spread of the rollers against the increased resistance of the springs swages the part into the channels in the die-block. The formed part is ejected by means of the double-studded plunger-rod J.

The reason for the departure from the original specifications in making this piece angular at the corners was to distribute the bend over two points and thus provide more metal at the points where the most severe stretching action occurs. The forming action of the die causes some of the bead to be absorbed in the bent portion. This flattening of the bead is indicated at C, Fig. 1. However, the flattening at this point is not objectionable, and the production of the part is satisfactory, both as regards form and strength.

The Need for a Revival of Apprentice Training

IN an address before the last meeting of the American Gear Manufacturers' Association, H. H. Kerr, president of the Boston Gear Works, Inc., North Quincy, Mass., spoke on the subject of trade education. He mentioned that the trade schools may be found very helpful in connection with an apprentice training system. In his own plant, boys who have finished two years in a trade school are taken into the shop for the completion of their training and given a diploma. Very good mechanics have been trained in this way—men who have been loyal to the company that provided their training. How well they are thought of in the plant may be judged from the fact that several departments usually ask for their services on the completion of their training.

Referring specifically to the system used by the Boston Gear Works, Mr. Kerr said: "In choosing boys, we demand the following qualifications: Physical soundness, at least average mental keenness, and such a desire to learn to be a mechanic that sacrifices will be willingly made in order to accomplish this purpose. The consent of the parents must be had, and a probationary period of six months worked out before a definite contract is made.

"As the boy progresses, we try to instill in him the dignity of labor and the pleasure of accomplishment. We endeavor to make him independent and able to stand on his own feet. We teach him thrift by savings, taking out insurance, and eventually home ownership.

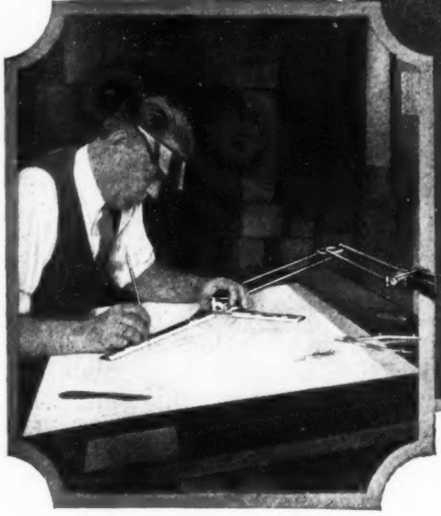
"It has been our purpose to spend time and, if necessary, money to bring to the attention of the present generation the opportunities available. No boy or girl, no matter what their circumstances are, if they have the desire to learn, need go without an education today, with the facilities of the institutions that are open in all industrial communities.

"As stated, in order to get the best results from the boy, the help and cooperation of the parents must be had. Too many parents still do not want their children to have to do the things they had to do. They seem to forget that hard work never hurt anybody, and that the things worth while in this world are generally gained by hard work and sacrifice."

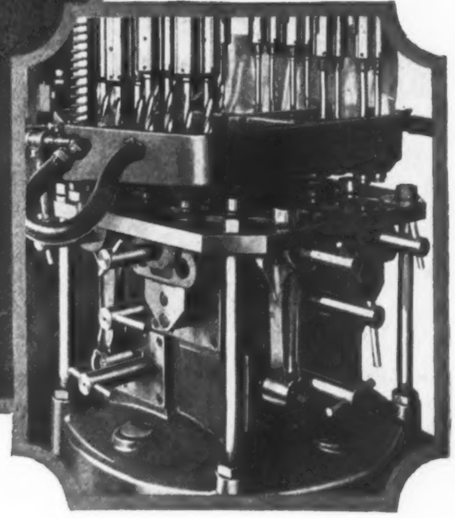
* * *

Belt Drive for Airplane Propellers

An unusual experiment has recently been made on the use of V-belts for driving airplane propellers. In a recent 300-hour test conducted at the Casey Jones School of Aeronautics, Newark, N. J., an airplane propeller was driven by power transmitted by six commercial V-belts of the type made by the Manhattan Rubber Mfg. Division of Raybestos-Manhattan, Inc., Passaic, N. J. The results are reported as having been highly satisfactory. All the details of this test are available in a bulletin that may be had from the company mentioned. The use of V-belts for this application will certainly be of interest to engineers.



Design of Tools and Fixtures



Machining Tobin Bronze Pressure Forgings

By BEN CLARK, Newark, N. J.

The Tobin bronze forging *A* shown in Figs. 1 and 2 is machined on a four-spindle Goss & DeLeeuw chucking machine. The end *B* is first bored and tapped, the work being held in formed jaws attached to the regular two-jaw chucks. The end *C* is machined concentric with end *B* within 0.002 inch, and the length is held within 0.005 inch.

The fixture shown in Fig. 1 was developed for holding the part *A* by the finished end *B*. The base of the fixture is made to suit the chuck-holding screw holes in the machine turret. The smaller portion of pilot *D* fits the regular chuck pilot holes in the turret, and the larger portion of this pilot locates the fixtures. Although the machine has only four work-spindles there are five fixture positions, the extra station being for loading.

The square end of the clamping screw *E* is in line with the regular chuck crank-handle that is mounted on the turret housing in a bearing which allows the crank to slide into and out of engagement with the clamping screw. A safety device makes the removal of the crank necessary before the turret indexing mechanism can be operated.

On screw *E* is a nut *F*, integral with a pin *G* that rides in the slot *H* in the flange of the pilot *J*. To load the fixture, screw *E*, which has a left-hand thread, is turned by the crank in a counter-clockwise direction nearly to the limit of travel of nut *F*. The work *A* is then screwed on pilot *J* by hand against the locating plate *K*. Screw *E* is next turned clockwise, causing the pin *G* in slot *H* to rotate pilot *J* and to lock the work in place. Parts

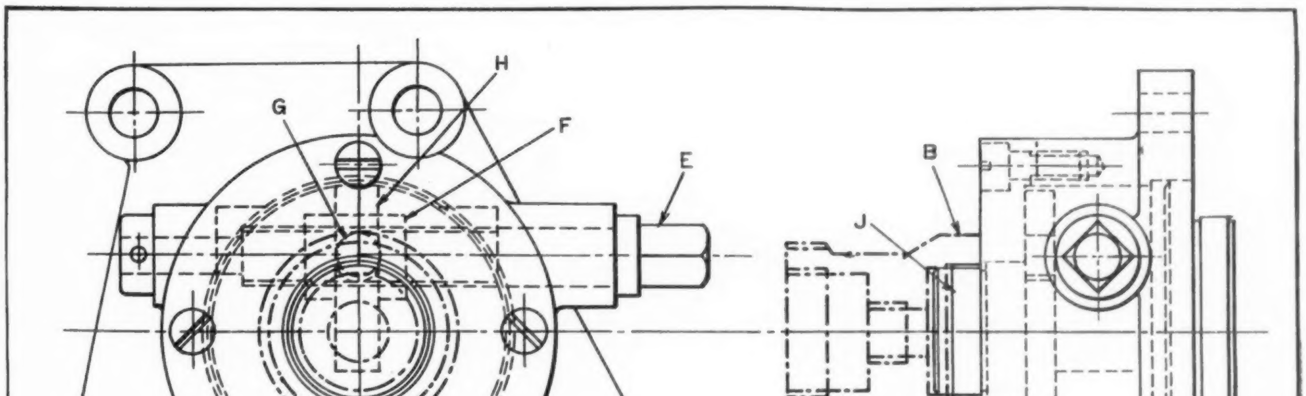


Fig. 1. Fixture Used on Four-spindle Chucking Machine for Holding Part A

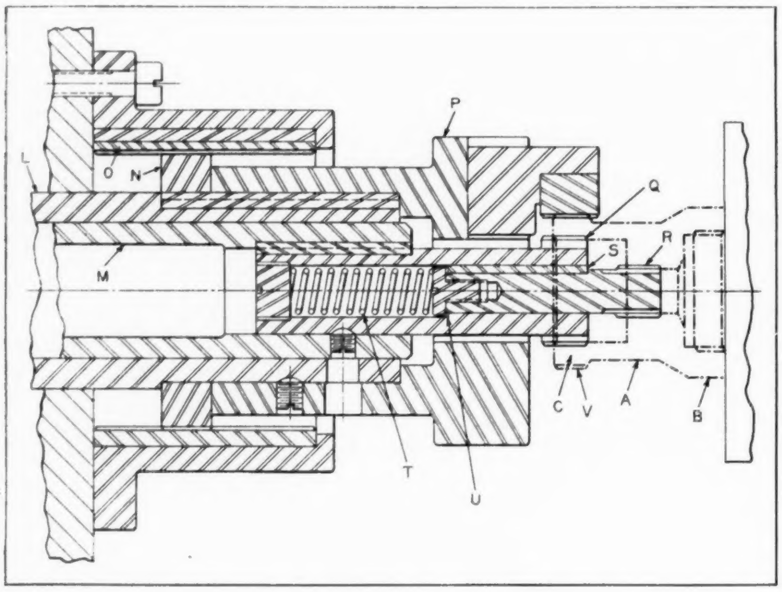


Fig. 2. Tapping and Threading Tool which Produces Two Internal Threads and One External Thread Simultaneously

of different sizes can be handled by providing suitable plates *K* and pilots *J*.

The facing, turning, boring, and reaming of end *C* is accomplished in the same general manner as in the case of end *B*, but the threading is more difficult, due to the fact that there are two tapped holes of different leads. The outside thread at *V*, Fig. 2, is 12 pitch, the large tap *Q* 16 pitch, and the small tap *R*, 20 pitch. The threading mechanism consists of an automatic reversing motion and slide carrying two spindles *L* and *M* which are keyed together so that they can slide endwise independently. The lead-screw *N*, running in nut *O*, controls the head on the outer spindle, and a similar arrangement controls the inner spindle head.

A special die-head *P* on the outer spindle *L* having a 12-pitch lead-screw and nut at *N* and *O* is used to cut the thread at *V*. The special tap *Q*, mounted in the internal spindle *M*, taps the 16-pitch thread. Tap *R* has a sliding fit on key *S* in tap *Q* and is acted on by spring *T*; this spring normally closes the gap at *U*, which is equivalent to the difference in the lead of the 16- and 20-pitch threads on the length of thread cut. This arrangement enables tap *R* to start cutting before tap *Q* begins to cut, but the two taps finish at the same time, on account of the coarser pitch of tap *Q*. The spring *T* allows tap *R* to recede as it is fed in by its own thread.

Precision Boring in a Drill Press

By C. F. STAPLES, Birmingham, Mich.

Numerous articles have been written and much has been said regarding precision boring with diamonds and cemented-carbide tools in precision boring machines of the semi-automatic type. Many products have been improved by the use of such equipment. A rather unusual precision boring operation performed with cemented-carbide tools on an ordinary drill press is described in this article. In addition to accuracy, high production was required of this fixture, which is of rather unique design.

In this case, two holes are bored in a valve body *Z*, Fig. 1, in one station of the fixture, while the finished part at *Q* is being unloaded from the second position and a new piece loaded and clamped ready for boring. The first operation is: Drill two holes 13/32 inch in diameter; ream to 0.412 inch in diameter. The parts are then bored in the fixture illustrated to 0.4215 to 0.4218 inch on the diameter. The specifications call for a straight smooth hole 3 inches long, in cast iron. The over-all length of the part is 3 1/2 inches.

Fig. 1 shows the two-station rotary indexing fixture which was designed for use on a drill press. The taper-shank boring-bar *A*, shown in the foreground, fits into and is driven by the drill press spindle. In order to hold the work as nearly central as possible, locating plugs *B* were made with a slip fit in the reamed holes of the work and in the two bushings located in the base of the fixture. Thus, parts under size in the reamed holes could not be located in the fixture, as any extra stock left for boring would prevent the boring-bar from entering the reamed holes, in which the bar has only a few thousandths of an inch clearance.

The cross-sectional view, Fig. 2, shows the boring-bar supported top and bottom by rotary bushings *D*, and in position to start boring. These rotary bushings consist of an especially selected ball bearing assembled in an inner and outer casing. The top bushing is positively driven by the key *C*. The main object of this key is to keep the two slots

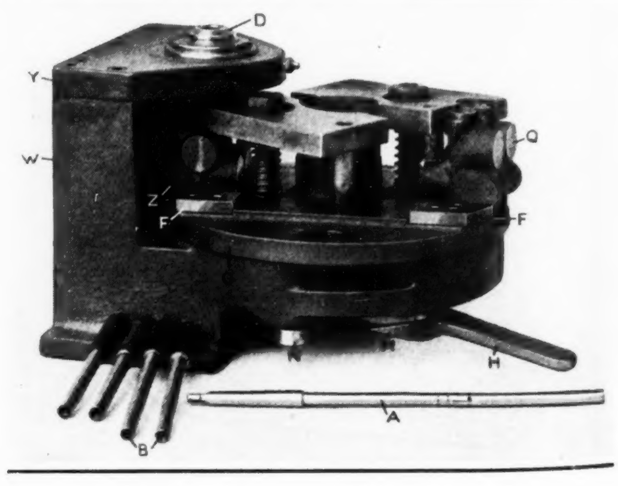


Fig. 1. Fixture Used on Drilling Machine for Precision-boring Valve Bodies

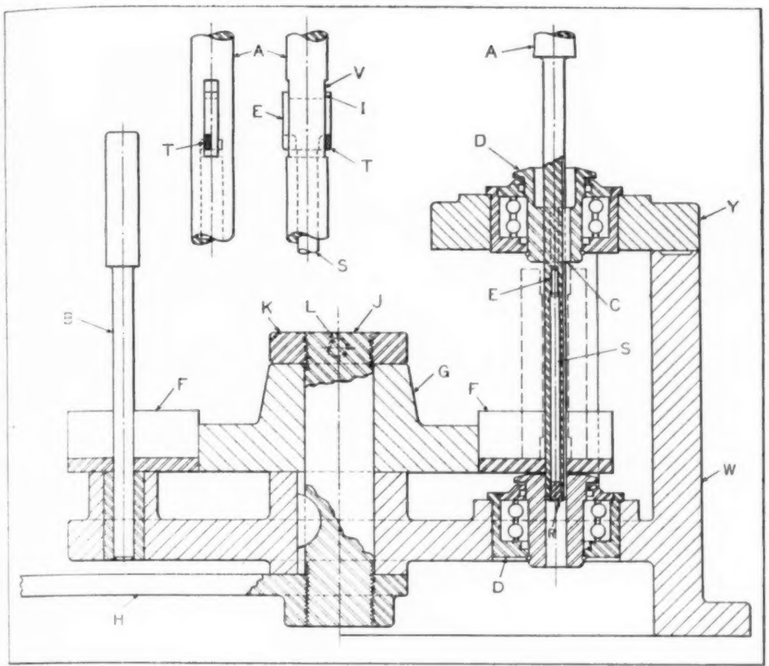


Fig. 2. Cross-sectional View of Precision Boring Fixture Shown in Fig. 1

in the upper bushing *D* in the right relation to cutter *E*. As the cutting lips extend past the sides of the bar, the slots in the bushing allow clearance over the two cutting lips.

In this type of boring-bar, all chatter and backlash or clearance must be entirely eliminated, and for this reason, the rotary bushings are used and the boring-bar is ground on the outside to the same diameter as the inside of the bushings. This close fitting is possible, as there is no relative rotation between the bar and the inner bushing, these parts being mounted in preloaded ball bearings.

In order to keep the over-all height of this fixture as low as possible, and also to keep the boring-bar as short as possible, tool-steel inserts *F* are provided in each station of the index-plate *G*. This plate is clamped in the boring position by the lever *H* and the hardened and ground stud *J*. In order to bring the lever *H* into the desired position when the index base is clamped, an adjusting nut *K* is provided on the upper end of the stud *J*. This adjusting nut is locked in the correct position by the set-screw *L*. The stud *J* is a slip fit in the index-plate and base *W* and is keyed to the base to prevent rotation when the plate is being clamped.

The lever *H* is shown in the clamping position in the illustrations. A cam *M*, Figs. 1 and 3, is cast integral with lever *H*. When the clamping lever is rotated to the left, the first few degrees will unclamp the index-plate *G*, and further rotation will bring the cam *M* into contact with the collar *N*, which is pinned to the index-plunger *O*. This collar has an angular shoulder to match the cam, and is moved down by the cam. Thus, one movement of the lever *H* releases the index-plate and moves the index-pin endwise, allowing the index-plate to be rotated to the next position. The plan view of the fixture in the upper half of Fig. 3 illustrates the clamping arrangement and the index-plate locating bushings *P*. As two holes are bored in each piece, two bushings are required at each station.

An enlarged fragmentary view of the boring-bar *A* and the cutter *E* is shown in the upper part of Fig. 2. This cutter-head is equipped with two tungsten-carbide tips *T* and is clamped by screw *R* and rod *S*. It is located by the ground slot *I*, which is a slip fit over the flats *V*, ground central on the boring-bar.

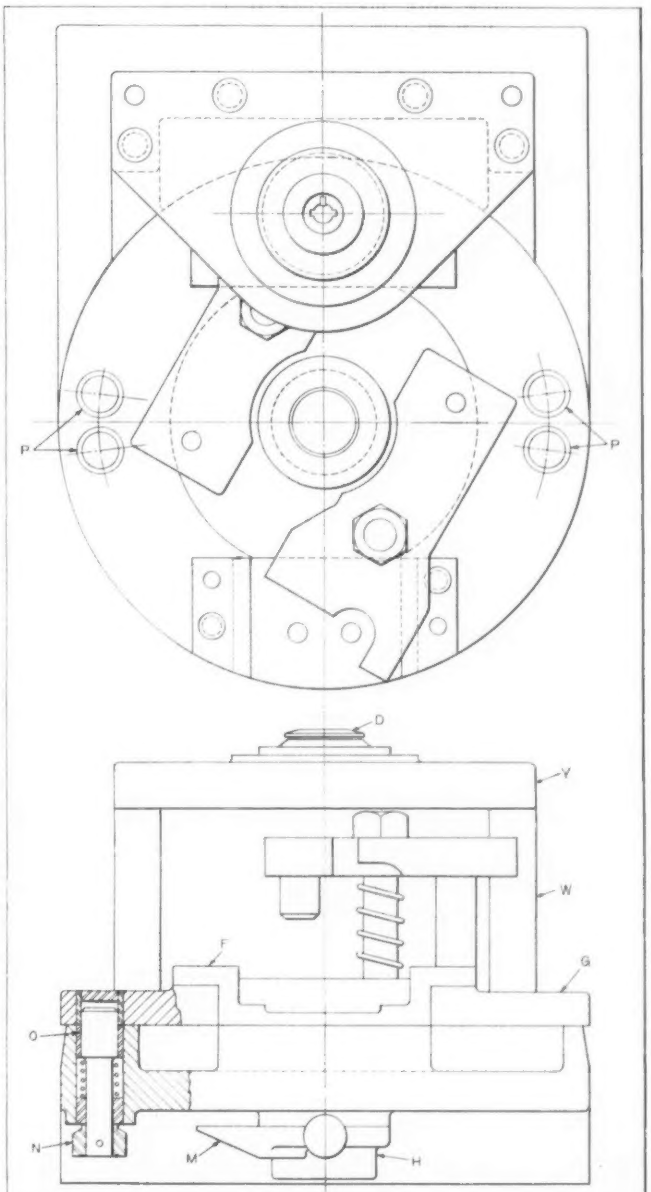


Fig. 3. Plan and Elevation Views of Precision Boring Fixture for Boring Valve Bodies on a Drill Press

It is evident from this description that the only requirements of the drill press are plenty of speed to drive the boring-bar and a mechanical feed, as the accuracy of the work produced is dependent upon the base *W;* the bushing plate *Y*, which is doweled and bolted to the base; and the method of clamping and locating the work on the index-plate and locking and clamping the index-plate solidly with relation to the rotary bushings.

Die for Piercing Fifty-Four Holes in Formed Sprinkler Top

By R. B. DUFFEY, Urbana, Ohio

The writer has been a reader of MACHINERY for a number of years, and being engaged in die designing and die building has found the numerous descriptions of unusual dies interesting and instructive. The die shown in Fig. 1 for piercing the holes in the sample sprinkler top illustrated in Fig. 2, which recently came to the writer's attention, may be of interest to other readers. This die was ordered by a customer for piercing fifty-four holes 0.028 inch in diameter in the top half of a brass sprinkler head and for piercing one 3/4-inch hole in the bottom half.

Fig. 2. Top of Sprinkler Head in which Holes are Pierced by the Die Shown in Fig. 1

The two formed pieces are soldered together after the piercing operations. The piercing must be done after the work is formed. If the holes are pierced previous to forming, they will be stretched out of shape. Although intended only as a temporary die and designed for low production, the die has been used to produce more parts than anticipated, and it still operates very satisfactorily.

The punches for the 0.028-inch diameter holes were first made by turning down the ends of tool-steel rods to the required diameter, but these were found to break off, requiring too frequent replacement. The punches were then made as shown by drilling the ends of drill-rod pieces *D* for a tight fit for the music wire punches *E*, which were driven in, cut off, and ground to length. The wire, having a tough quality, would not break, and yet it was stiff and hard enough to pierce the brass.

By lifting the punch-holder off the guide pins, these piercing punches can easily be removed when the wire keys *F* are taken out. Sets of six punches are held in each of the nine plates *G* shown in Fig. 1. The 3/4-inch punch *H* can be used for piercing the bottom half of the sprinkler head by backing down the cap-screws *A* until the small punches do not touch the work and then pushing the 3/4-inch punch *H* down into the operating position by means of the screw plug *I*, clamping it in place with the set-screw *J*. The illustration shows this punch in the non-operating position.

The 3/16-inch holes for the pieces *D* in the stripper plate *B* are drilled and reamed with the stripper plate clamped in position, so that the fifty-four holes for the punches and dies will be in accurate alignment. Three supporting studs *C* are used in the stripper plate to insure having this plate level, so that the punches will register with the die openings.

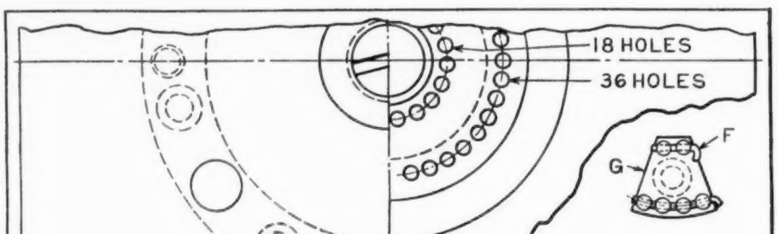


Fig. 1. Die Equipped for Piercing Fifty-four 0.028-inch Holes in Sprinkler Top and One 3/4-inch Hole in a Mating Part

* * *

If "Idle Hour" will kindly send us his name and address, we will be glad to reply to his communication—EDITOR

Questions and Answers

A Department in which the Readers of MACHINERY are Given an Opportunity to Exchange Information on Questions Pertaining to the Machine Industries

W. S. D.—Should the dimensions on the drawing of a dovetail slide which is made of cast iron and scraped, or of steel, hardened and ground, show the finished size; or should the figures on the drawing allow for the scraping or grinding of the slide?

The top slide not only fits in the dovetail, but also fits against a flat surface. The bottom slide is a detachable piece fastened to the bed; it also fits against the flat surface on the side.

Some designers say that the drawing should give the dimensions of the finished piece, while others claim that unless the figures show the milled dimensions, the milling machine operator may not leave sufficient stock, and the piece may be spoiled. What is the general practice?

This question is submitted to MACHINERY'S readers.

Responsibility for Noise and Vibration Caused by Manufacturing Operations

N. E. D.—Some time ago, we purchased a building and installed machinery therein. The owner of adjacent property threatens to sue us on the grounds that he cannot sleep on account of the noise and also that the vibrations are damaging his house. Can you cite any recent higher Court case in our favor?

Answered by Leo T. Parker, Attorney-at-Law
Cincinnati, Ohio

Yes, the case of Orleans Mfg. Co. v. LeBlanc [121 La. 249], and also Meyer v. Kemper Co. [158 So. 378], the latter being reported in February, 1935. In this case, a company purchased a vacant lot and built a factory on it. The owner of the adjacent property brought suit alleging that the company had installed in its plant an internal combustion engine and that when the plant was in operation, the excessive vibration from the engine caused every portion of his residence to shake—windows, furniture, mantels, and walls—and articles such as dishes on tables to rattle; also that the noise was of such a violent and disturbing nature as to make an ordinary conversation or sleep almost impossible. He asked the company for $5000 damages, and an injunction against operation of the plant.

However, the higher Court refused to allow damages or to grant an injunction, and said: "Noise alone or noise accompanied by vibrations may create a nuisance subject of an action for damage or injunction, even though it arises from the carrying on of a trade or business lawful in its nature. But, to have this effect, the noise must be excessive, unreasonable in degree, and of such character as to produce actual, physical discomfort and annoyance to a person of ordinary sensibilities."

Cutting Lubricant for Brass and Bronze

A. M. D.—What kind of cutting lubricant, if any, should be used for machining brass and bronze?

A.—In an article on the selection of cutting lubricants in February, 1933, MACHINERY, page 409, by H. C. Deckard, the author states that he obtained good results in machining brass, bronze, babbitt, and aluminum by using a cutting lubricant consisting of one part of soluble oil to fifteen to twenty parts of water. The best results on brass and bronze, however, were obtained by the use of paraffin oil. The paraffin oil may be used alone, although a slightly better finish is obtained by mixing one part of a good cutting oil to twenty parts of paraffin oil. This mixture gives excellent results in drilling, boring, reaming, broaching, or diamond-boring operations.

* * *

Hot-Pressing of Non-Ferrous Metals

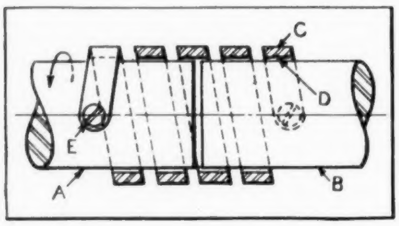
The application of the hot-pressing process to the making of non-ferrous alloy parts in large quantities has assumed an ever increasing importance. This process consists of heating a slug or blank and squeezing it to the desired shape in a high-powered press. The accuracy obtained is within limits of a few thousandths of an inch. The production cost is greatly reduced, as compared with former methods. Smooth and accurate parts having a remarkably high tensile strength are thus finish-formed from billets at a rate of up to 350 an hour. As a rule, it may be said that the hot-pressing process is best suited to production lots of not less than 2000 heavy parts or 10,000 light-weight parts.

Ideas for the Shop and Drafting-Room

Time- and Labor-Saving Devices and Methods that Have been Found Useful by Men Engaged in Machine Design and Shop Work

Simple Flexible Coupling for Small Shafts

It is often necessary to provide some form of flexible connection between the ends of two shafts. Such a connection may be required to allow for expansion and contraction, compensate for misalignment, and absorb shocks. The arrangement generally consists of two flanged couplings pinned or keyed to two shafts between which there is interposed some form of flexible material.



Helical Spring Used as Flexible Coupling

The flexible coupling illustrated was devised for use where a simple inexpensive arrangement is required. It consists of a spring *C* of rectangular section having sufficient strength to withstand the maximum driving torque. This spring is wound so that when it is in the free position the bore *D* is 1/32 inch larger in diameter than the diameter of the shafts *A* and *B*. A clearance hole was drilled in each end of the coil for a round-head screw *E*. Suitable holes were drilled and tapped in each shaft and the spring connected to the two shafts by means of the round-head screws.

Under normal operating conditions, the spring is capable of acting as the intermediate driver without any perceptible change in diameter. If, however, there is an overload at starting, the spring will gradually wind itself around both shafts until it is a snug fit over the shafts. Thus the spring absorbs the shock of starting and grips the shafts so that a positive drive is obtained. In gripping the shafts as described, the spring allows the shaft *A* to turn a fraction of a revolution before shaft *B* begins to turn. As the resistance of shaft *B* to the turning force diminishes, the spring unwinds until it is in its original position.

New York City — JOHN A. HONEGGER

Force Fit Assembling of Parts on a Shaft

Several parts can be assembled so securely on a shaft by means of force fits that there is little chance that they will slip or become loose if the work is done properly. For the last twenty years, a well-known manufacturer of ammonia compressors has assembled the piston-driving eccentrics on their shafts by force fits. Practically no trouble from slippage or loosening of the parts has been experienced, in spite of the fact that no keys or other means of fastening are employed to hold the parts in place.

When three or more eccentrics are assembled on one shaft, they are bored and reamed to different diameters, so that the first eccentric to be assembled does not have to be forced over the portions of the shaft to be occupied by the other eccentrics. The shaft is machined with slight steps to give the proper force fit for each eccentric. This avoids undue burnishing of the bore of the eccentric first assembled and the poorer fit resulting from such burnishing.

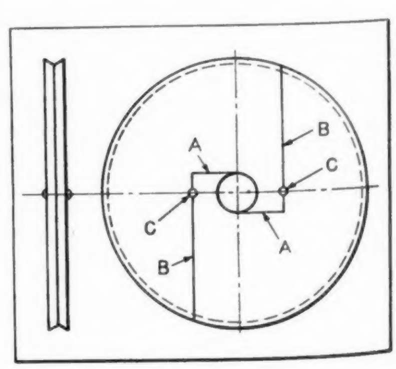
Newark, N. J. — C. C. TOMNEY

Self-Locking Split Pulley

In order to mount a grooved pulley on a shaft with as little lost time as possible, the writer split the pulley, as indicated by the lines *A* and *B* in the illustration. This method of splitting a pulley is original so far as the writer knows, and may be of interest to others.

The first step in splitting the pulley was to drill two rivet holes *C* and countersink them at each side. Then the two cuts *A* were made with a hacksaw, followed by the two cuts *B*. The two halves of the pulley were then placed on the shaft by sliding the two pieces together. Finally, two rivets, hammered tight in holes *C*, served to hold the pulley on the shaft tightly enough for the light drive required. The effect of the riveting, of course, was to expand the rivet holes at the saw cuts, thus tightening both halves on the shaft.

FRANK MUIR
Hamilton, Can.



Method of Splitting Pulley

Estimating Costs of Press Tools

By C. W. HINMAN

THE first essential in good tool engineering is to know when and when not to incur tool designing expense. This necessitates knowing when, where, and how to specify manufacturing tolerances, and which grade of tool is best for the work. It is not always easy to determine whether the tool should be of the best quality (regardless of price), of medium quality, or in the lowest price class. The ability to decide such questions is acquired only through years of practical and varied experience.

A quick rule for obtaining the approximate cost, in dollars, of the pattern, castings, and steel, which are the raw materials required for any press tool, is to multiply together the length, breadth, and closed height of the tool and divide the product by 20. For accurate material costs, however, the cubic inch contents of each member of the tool, in the rough, are computed and multiplied by the corresponding weight of the material, in pounds per cubic inch, times its cost per pound. If the die set is a commercial one, the price can be taken from the manufacturers' catalogues.

The toolmaking expense may be ascertained from the cost cards when they include costs for similar tools made at a previous date. If cost cards are not available, the cost for each part should be estimated separately, and the cost for the final assembly and for testing the die should be added. Another method is to take the average of the estimates made by three experienced men. Special features, magazine feeds, inserts, and complicated design are all factors that must be considered. The grade of the tool required and the danger of fracturing frail parts when hardening must also be taken into account.

Diemaking costs depend largely upon the ingenuity of the diemaker and whether he uses modern or antiquated machine tools. The hourly overhead and designing expenses, which vary in different localities, must be included. In some shops, the designing expense is prorated on the basis of the previous year's tool expense and is included in overhead charges.

In estimating manufacturing costs, the weight, in pounds, of the material required for blanking 1000 pieces is found by multiplying the area, in square inches, of the material used for one blank by 7.3 times the weight of the raw material per square foot. This allows 5 per cent for waste ends. The cutting tonnage pressure required is determined by multiplying the length of the cut edge, in inches, by the thickness of the material times 15 for brass, copper, or German silver, or 25 for steel. The safe pressure, in tons, for a punch press is equal to the square of the crankshaft diameter at its bearings multiplied by 3 1/2.

When the press is fed by hand, 40 per cent of the total number of press strokes are utilized. If an automatic roll-feeding attachment is used, 80 per cent of the press strokes will be production strokes when the blank centers are less than 3 inches apart. If the blank centers are more than 3 inches apart, this percentage must be reduced to compensate for the additional time consumed.

The method of finding the total cost of labor and material T per thousand blanks is shown by the following example: Assume that 56 pounds of sheet steel is required per thousand blanks and a No. 3 press having a speed of 100 strokes per minute N is used. The press is fed by hand by an operator whose pay S is 60 cents per hour. Assuming that the material cost is 3 1/2 cents per pound, the cost M for 1000 blanks would be $1.96. The used strokes number 2400 per hour, or 40 per cent of the total number of strokes per hour. The operator's pay is 25 cents per thousand blanks. Thus the total cost T for labor and material is $2.21 per thousand blanks or 0.00221 cent for each blank. The monetary return from the sale of the scrap material is used to balance or offset the cost of tool upkeep.

The following formula can be used for finding the cost of labor and material:

$$T = S \div 0.024\ N + M$$

This formula is used when the press is fed by hand. For finding T when a roll feed is employed, use the formula

$$T = S \div 0.048\ N + M$$

In the foregoing formulas we have: M = material cost per 1000 blanks; N = number of press strokes per minute; S = operator's hourly wage; T = total cost of labor and material per 1000 pieces. The manufacturing overhead cost for the time required to produce the blanks should, of course, be added to T in both cases.

For forming operations, the cost can be closely approximated by using a stop-watch and going through the motions involved in the operation. Someone should hold the stop-watch and be ready to start and stop it instantly. When all is in readiness, the operator should pick up an imaginary blank and go through the motions of placing the piece in position in the die, pressing the clutch treadle, and removing the piece from the die. This make-believe operation should be gone through several times and the average time noted. From this, the labor cost per thousand pieces is found.

A Method of Evaluating Qualifications for Promotion

AT the last annual meeting of the National Machine Tool Builders' Association, Everard Stubbs, factory manager of the Fellows Gear Shaper Co., Springfield, Vt., and chairman of the Association's Committee on Apprentice Training, called attention to an interesting chart for recording an evaluation of the qualifications of members of an industrial organization. This chart, as shown in the accompanying illustration, is used by different men in the organization under whose observation the person whose qualifications are being evaluated may come. Foremen, for example, use this chart to record their impressions of the men working for them; superintendents may use it to evaluate the qualifications of their foremen. Whenever possible, the opinions of several men should be compared.

This analysis chart is far superior to those that show percentages for different characteristics. These percentages are put down for each characteristic and totalled. Such a procedure may lead to grave errors. There are some men who will rate high as an average all the way through, but who have some one quality that would make them impossible for any executive or supervisory job.

In the chart shown are listed certain qualities to be measured; the answers can, in many instances, be given simply by underlining a word. Charts of this kind are being used in several organizations and have been found extremely helpful. The man responsible for the employment department keeps cards of this kind for a certain number of men—not for the whole shop. The men whose names get into this card index are those to whom it appears to be worth while paying special attention—men who seem to have the qualifications for supervisory positions. The chart has proved to be the means of discovering the qualifications of excellent men who otherwise would have passed unnoticed.

Quoting Mr. Stubbs: "These cards are far better than a percentage system. They can be passed to any foreman in your shop to evaluate any man who has worked for him. The foreman can easily underline the characteristics he has found in the man under consideration. His report may not agree with that of your employment manager; it may not agree with that of the next foreman; but you are able to get a fairly accurate picture of the man you have working for you, and to find out how much further training you can wisely give him, and whether you are going to get a foreman out of him who will be able to train others."

Personal Analysis of....................................

by.......................... Date....................

Note: Development of special material (tomorrow's foremen, junior executives, engineers, operators, salesmen) is the joint responsibility of today's foremen and officials, and of the candidate himself. This analysis is a record of progress, an index of future value, a friendly criticism, a report of your own important part in a constructive plan. You are dealing with human ambitions and real business needs. Be conscientious, kindly, fair, frank. How to Use This Chart. Underline word or phrase which fits the case. Add modifying signs as needed ("yes, no, not, too, very, hardly, ?, 60%," etc.). Mark important points in red. For extended comment on important points, write "See note" and use back of this paper. Skip sections crossed out. Date and sign, and return promptly to..............................

Physical Health Vigor Speed Endurance Recovery Nerves Appearance	**General Type** Introvert Extrovert
Social Cheerfulness Tolerance Sympathy Helpfulness Modesty Honesty Veracity Dependability Fairness Self-control Thrift Teamwork Home life	**Remarks:**
Mental Analytical ability Mechanical ability Creative imagination Persistence Teachableness Emotional control Concentration Memory Depth Outside interests	**Best Adapted For:**
Workmanship Accuracy Versatility Promptness Thoroughness Up-to-date-ness	**Criticism:**
Training Mechanics Engineering Mathematics Geometry Apprenticeship Estimating Administration	
Leadership INITIATIVE—Vision Plans Follow-up WILL POWER—Stubborn Patient Self-mastery ENERGY—Intense Steady Nervous Physical ENTHUSIASM—Constant Excessive Contagious SELF-CONFIDENCE—Modest Sure Visionary Touchy DECISION—Quick Flexible Intuitive Analytical COURAGE—Aggressive Quarrelsome Quitter RESPONSIBILITY—Accepts Delegates Fails Excuses GENERAL KNOWLEDGE—Economics Politics Business LOYALTY—To men To management Suspicious Rooter SELF-ANALYSIS—Morbid Blind spots Confusing AMBITION—Too much Wrong direction Well founded MATURITY—Early Late All-round Never grow up TEACHING GIFT—Native Trained Adaptable Patient SENSE OF HUMOR—Irritating Smoothing Gullible JUDGE OF MEN—Driver Leader Disciplinarian	**Commendation:** **Needs More Training?**

Dies for Forming Wire Links on Four-Slide Automatics

MULTIPLE-SLIDE automatic wire-forming machines have made possible the extremely low prices at which hairpins, safety pins, paper clips, and similar articles are sold today. A four-slide machine, such as is used for forming wire articles of this kind, has also made possible the economical production of links and hooks of the shapes shown in Fig. 1. These articles are all formed from rolled gold wire by dies or forming tools designed for use on a four-slide wire-forming machine.

Design and Operation of Automatic Wire-Forming Machines

The slides on which the forming dies or tools are mounted are arranged around the four sides of a central form-holder provided with arbors or forming blocks. The forming tool slides can be operated in any required sequence by means of cams mounted on shafts running along the four sides of the machine. The shafts are connected by miter gears and are thus synchronized. In Fig. 2 is shown the arrangement of the four horizontal dies or tools *A*, *B*, *C*, and *D* employed on a four-slide machine for forming the piece indicated at *W*, Fig. 1. Two of the four slides may be identified by the reference letter *E* in Fig. 2.

The wire from which the parts are formed is fed automatically through a quill *F*, carried in the bracket *G*. This bracket also carries the cam-operated slide *H*, in which is mounted the cutting-off blade *K*. In cutting off the wire, the blade *K* moves across the face of the quill *F* which serves as a cutting-off die.

The central form-holder *L* is mounted vertically in a slide, and carries the two arbors *M*, around which the wire is formed by the tools in the other slides. The arbors *M* are thus located above an opening through the center of the machine bed. This opening is somewhat larger than the dotted outline of holder *L*. Holder *L* can be raised automatically during the cycle of operations to bring different sections of the forming arbors into the operating position, when the nature of the work makes this procedure desirable.

A stripper plate *N* is arranged, as shown, around arbors *M*. The stripper plate operates automatically, removing the work from the forming arbors after the operation through the action of the plunger *P*, which is operated by a lever and cam, as in the case of the tool-slides.

At the beginning of the cycle of operations performed by the tools shown in Fig. 2, the slides are withdrawn so that the tools clear the wire when it is fed forward and also when the long free ends

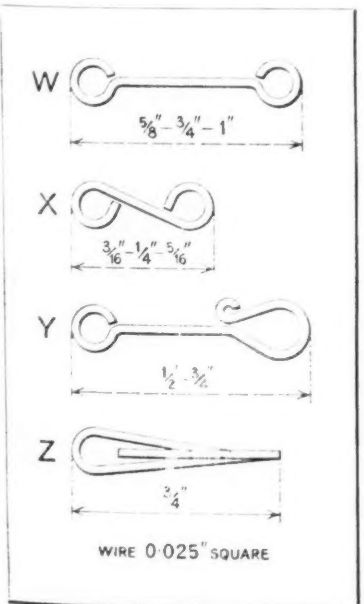


Fig. 1. Rolled Gold Wire Links Produced on Automatic Machine

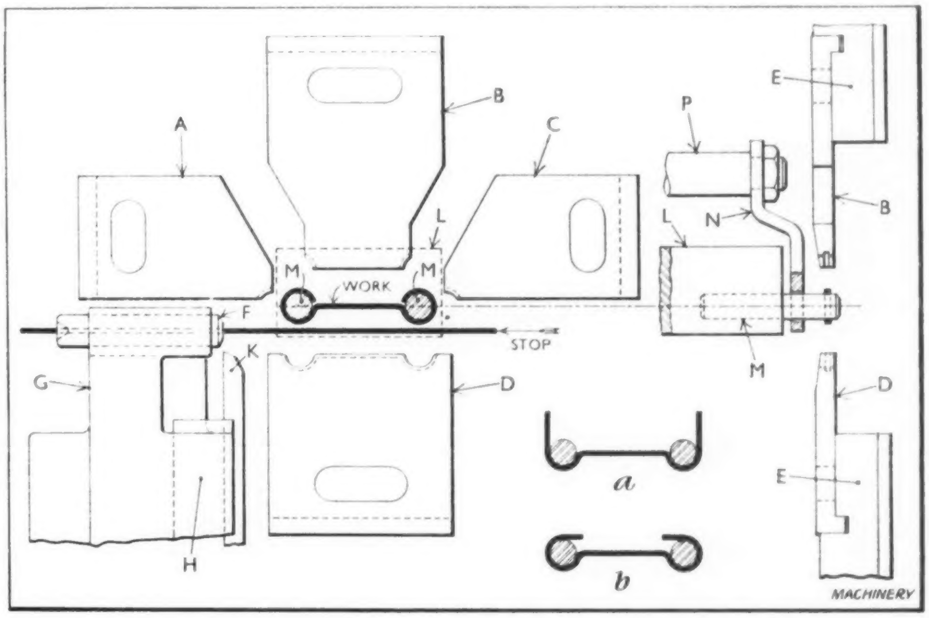


Fig. 2. Die or Tool Equipment Used on Four-slide Automatic Wire-forming Machine for Producing the Link Illustrated at W in Fig. 1

are swung around the arbors M during the initial stages of the forming operation. All forming tools used for this job are grooved to receive the wire, which is thus supported in one plane during the operation.

After the wire is automatically fed to length, the cutting-off tool K severs it against the face of quill F. The travel of tool K is just sufficient to sever the wire and no more. The forming tool D follows very closely and partly forms the work around the arbors M, the result being as indicated in diagram a. In the meantime, tools A and C have followed up as closely as possible and now operate on the free ends of the wire, forming the part to the shape shown in the diagram b.

Next the rear tool B moves forward, completing the forming of the eyes of the link. All slides then recede and the stripper N operates simultaneously to clear the finished link from the arbors M. The work falls through the opening in the bed of the machine and the cycle is repeated. Production rates on this part are very high, the output being 300 per minute. This production rate is also attained on the other parts shown in Fig. 1.

Tool Equipment for Producing an S-Shaped Hook

The tool equipment for producing the S-shaped hook X, Fig. 1, is shown in Fig. 3. In this case, the wire is fed between the arbors M, mounted in the vertical form-holder. After the wire is fed forward and cut off to the proper length, the first forming tool to come into operation is the one shown at R, carried on the cutting-off slide K. The

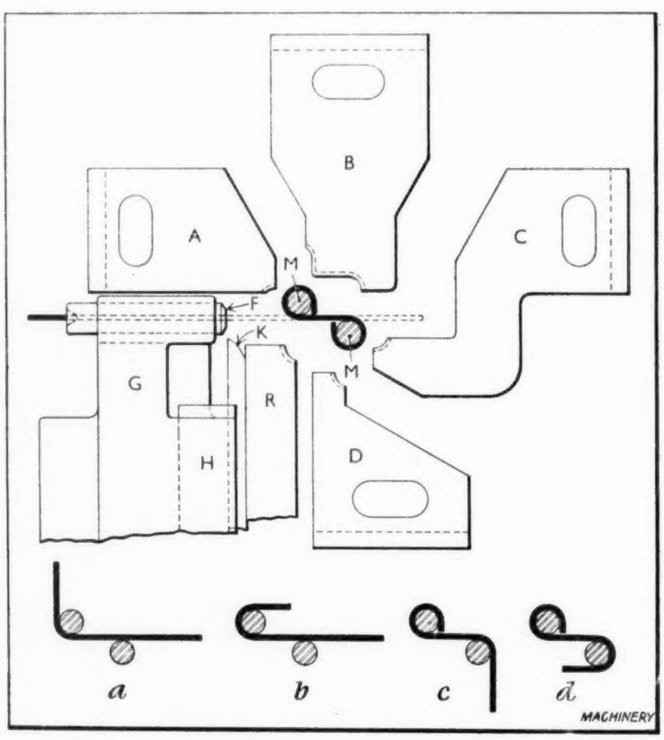


Fig. 3. Set-up for Forming S-Shaped Hook X, Fig. 1, on a Four-slide Wire-forming Machine

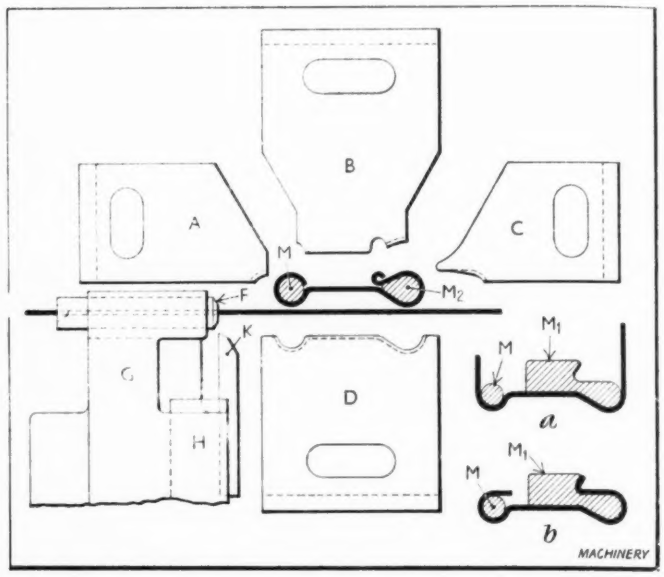


Fig. 4. Four-slide Automatic Wire-forming Machine Set-up for Producing Hook Y, Fig. 1

distance traveled by slide K is sufficient to permit tool R to bend the left-hand end of the wire around arbor M, so that the wire has the form shown at a.

Tool A then operates immediately, producing the result shown at b. The rear tool B follows closely, forming the work to the shape shown at c. This completes the forming of the eye to the left and produces the first bend on the eye to the right. The offset forming tool C advances next, producing the result indicated at d. Finally the front forming tool D advances and completes the forming of the eye to the right. The stripping of the work from the forming arbors completes the cycle of operations, which is repeated automatically.

Set-Up for Forming a Wire Hook-Shaped Link

The hook-shaped link shown at Y, Fig. 1, is produced on a four-slide wire-forming machine with the tool equipment shown in Fig. 4. One of the most interesting features of this equipment is the provision for automatically raising the form-holder to bring a form of different shape into the operating position. The shape of the arbors or forms M and M_1 used during the initial stages of the operation is indicated at a and b. For the final stage, however, the form is raised, so that the bending or forming portion presents the shape indicated at M_2.

After the wire is fed to length and cut off, tool D advances and forms the wire to the shape indicated at a. Tools A and C then advance simultaneously, producing the form shown at b. The form-holder is now raised, presenting the section or shape shown at M_2. Next, forming tool C recedes and the rear forming tool B comes into operation, completing the forming of the eyes at each end of the wire.

The link shown at Z, Fig. 1, is perhaps the most difficult to form of the four pieces illustrated. Once a machine is set up, however, the work proceeds as

rapidly as with the other types. The forming tool equipment required for this part is shown in Fig. 5. Referring to the upper plan view, the wire is first fed to length and cut off, following which tool *D* advances and forms the wire to the shape indicated at *a*. This carries the wire to a supporting groove in an auxiliary stop *S*. The side tool *A* then advances, producing the result indicated at *b*. The rear tool *B* now carries the forming process to the stage indicated at *c*.

Referring to the lower right-hand corner of Fig. 5, we see an elevation view of the members that complete the final forming operations, the forming arbor M_1 being shown in cross-section. The auxiliary forming tool *T* is brought up into position by the rear slide, producing the result indicated at *d*. The side of the forming tool *T* adjacent to the stop *S*, has a groove that is flared so that it gathers the wire and forces it into the correct plane for the bending operation. Stop *S* is also provided with a flared groove to facilitate the entrance and removal of the wire.

Slide *C*, carrying the swing forming tool *U*, next comes into operation. Member *U* forms the work as indicated at *d* and starts the bend. Continued movement results in engagement between the swing tool and the cam *V*, carried on the front slide *D*, with the result that the swing tool is forced upward to complete the bending operation. Cam *V* is clear

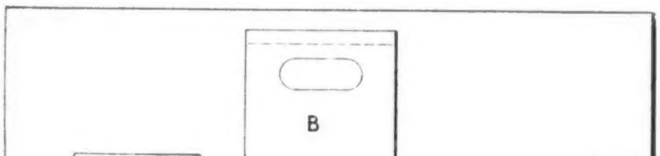


Fig. 5. Tool Set-up Used on Four-slide Wire-forming Machine for Producing Link Z, Fig. 1

of the free end of the wire during the operation of the forming tool *T*, the engaging lip on the swinging tool *U* being offset accordingly. The position of tool *U* is controlled by the adjusting screw shown, and is normally retained in its lowest position by means of a spring.

On the completion of the last bend, tool *T* recedes first, tool *A* next, and then the others simultaneously, leaving the work free to be stripped from arbor *M*. In all cases, due allowance is made in the forming tools and arbors for the natural springback of the wire. Three machines equipped as described are kept in continuous operation by one man.

* * *

Is the Ohio "Use Tax" a Protective Tariff Against Other States?

The legislature of the state of Ohio has passed a bill known as the "Use Tax Law" which to all intents and purposes would appear to accomplish everything that a protective tariff against the other states in the Union would accomplish. Briefly, the state of Ohio imposes a tax, equal to the Ohio retail sales tax, for the privilege of using within the state tangible personal property purchased in other states subsequent to January 1, 1936, and in respect to which property, therefore, no sales tax has been collected by the state of Ohio.

In the words of the Tax Commission of Ohio, "The primary purpose of the Use Tax is to *protect* the merchants of Ohio from the discrimination arising by reason of our *inability*, under *federal law*, to impose a tax upon sales made to our residents by competitive merchants *in other states*." [Italics ours].

The reference to "inability under federal law" presumably refers to the very wise provision of the Constitution of the United States which reads: "No state shall, without the consent of the Congress, lay any impost or duties on imports or exports." Hence the question: Is the Ohio "Use Tax" a protective tariff against the other states? Presumably the Supreme Court will ultimately be asked to decide this.

The state of Ohio is not the only state that has passed laws, the effects of which are similar to those of a protective tariff against other states. At least one other state has done so; and in the state of New York certain merchants associations have tried to so interpret a state law as to impose a prohibition on merchandise brought in from another state. The effort to limit individual freedom to carry on what has always been considered legitimate business pursuits is certainly in the air.

* * *

Engineers are remaking the world, but "statesmen" are unmaking it.—*Commerce and Finance*

Machining a New Free-Cutting Aluminum Alloy in Automatics

After Many Years of Experimenting, a New Free-Cutting Aluminum Alloy has been Produced that has Already Found Wide Acceptance for Screw Machine Parts

THE new free-cutting aluminum alloy 11S, which was described in August, 1935, MACHINERY, page 751, was developed principally for the fabrication of parts in automatic screw machines. In a paper read by J. F. Coneen, of the Aluminum Co. of America, before the February 7 meeting of the Screw Machine Products Association in New York City, considerable data pertaining to the machining of this new aluminum alloy in automatic screw machines was presented.

This alloy is adaptable to unusually high-speed production. It can be machined by using the maximum spindle speed available on standard types of automatic screw machines, whether for turning, forming, drilling, or cutting off. Speeds as high as 800 surface feet per minute have been used without any indication that the speed was too high. However, when a high surface speed is used together with a heavy feed, the chips will be quite hot and the finish will be rough, although no noticeable effect on the tool has been observed in tests of comparatively brief duration. It is to be expected that the continuous use of a feed heavy enough to produce a marked rough finish on the work will ultimately break down the cutting edges. The same results may be expected with slower speeds if the feed is too heavy. This would indicate that the tool feed is of more importance than the surface speed. The same condition has been noted in machining brass.

For threading and tapping operations, a speed approximately one-third of that used for other operations should be employed. This, in fact, is considered good practice, irrespective of the material being machined. On machines where the work-spindle is reversed in threading operations, aluminum, being very light, presents an advantage, since the lower inertia places less stress on the equipment in reversing.

Kinds of Steel Best Adapted for Machining New Alloy

The best steel to use for tools for machining this new aluminum alloy appears to be the standard 18-4-1 high-speed steel. It is generally used for drills, taps, and forming tools.

Carbon steel is used for many applications when the cutting speeds are not too high. For example, a 1/16-inch drill running at 10,000 revolutions per minute would have a cutting speed of 164 surface feet. Such drills can be made of carbon steel, and, as a matter of fact, many small drills for aluminum are made of this material. In fact, drill manufacturers still make a very large number of carbon steel drills for many other purposes as well.

For holes of shallow depth, standard twist drills are recommended. For deep holes, drills designed for Bakelite or "straight-way" two-flute drills are preferred. Highly polished flutes are desirable, as there is less resistance to the chips. The standard twist drills can be used for reasonably deep holes, but the other two types have certain advantages. The twist drill developed for Bakelite, having a slower twist than the standard, permits the chips to pass out more readily. When these drills are used for drilling Bakelite, they are ground with an included point angle of 60 degrees. For drilling aluminum screw machine stock, the included point angle should be approximately 118 degrees, or the same as on standard twist drills.

Points in Designing Form Tools for Aluminum Alloy

Circular form and cut-off tools for aluminum screw stock may be made in accordance with the recommendations given in the Brown & Sharpe Mfg. Co.'s handbook "Construction and Use of Automatic Screw Machines." Generally, forming tools are made to be used without top rake. However, in many cases, it is necessary to grind them with some rake to correct slight errors in the steps of the tool. For machining some metals, a top rake up to 5 degrees is advantageous; but for machining 11S aluminum alloy, top rake is not necessary. As a rule, forming and cut-off tools are made with a 1/2-degree side clearance, which will produce a smooth side finish.

For any material, there is a limit beyond which it is not practicable to form pieces with a side forming tool that is not supported, as the side pressure becomes too great and the piece may spring or be twisted off. The limit is usually expressed

in the form of a ratio of the formed length to the smallest diameter. For 11S aluminum alloy, this ratio should not exceed 2.25.

A Suggestion for Box-Tool Design

In designing box-tools, the part of the tool bearing against the circumference of the work being turned should be ground to an 8-degree angle, and when set in place, should be parallel to the axis of the work. Chip clearance is obtained for machining many materials by grinding a 45-degree groove in the tool, starting at the front corner and increasing the width backward, the groove to be within approximately 0.010 to 0.025 inch of the front cutting edge. This produces a coiled chip that easily escapes from the holder. For machining 11S alloy, omitting the groove will, however, produce a smoother finish, and no difficulty will be experienced with the chips.

For taps up to 5/16 or 3/8 inch in diameter, two flutes are preferred. For larger taps, the number of flutes recommended by tap manufacturers is usually satisfactory. On chasers, a 10- to 15-degree rake on the cutting edge produces good results. On all threading tools, it is important that the chamfer on the front be equivalent to not less than one thread, in order to prevent rough and distorted threads.

The Importance of Ample Cutting Lubricant

There is a difference of opinion in regard to the kind and grade of cutting lubricant to use for machining aluminum alloy. For the 11S screw machine stock, lubricants such as are used for brass under similar conditions have been found satisfactory. Paraffin oil, of the same grade as used for machining brass, produces good results. A small percentage of lard oil may be added, the amount being best determined by trial. It is important to note, however, that an ample supply of cutting lubricant is required, the volume being more important than the pressure.

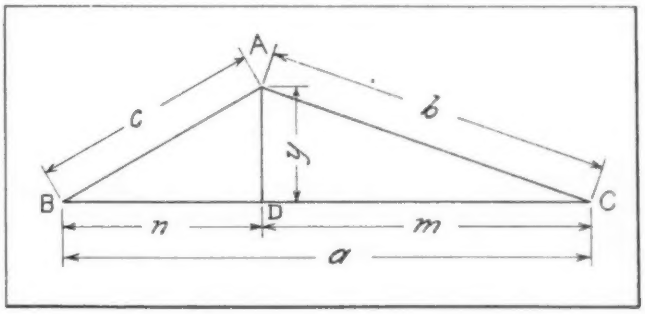
In selecting feeds, cam designers generally follow the directions given in the Brown & Sharpe Mfg. Co.'s handbook previously referred to. In many cases, the screw machine departments of individual firms have prepared feed tables based on past experience. Generally speaking, the feeds recommended for free-cutting brass are applicable to aluminum screw machine stock. Often these feeds can be increased. What can be done is best determined by experimenting with individual requirements.

There are numerous instances in which the feeds on certain tools are of no particular importance, because they are performing the shortest operation; yet in such cases, it is well to use a feed not less than about one-half of that which would be considered normal. Too fine feeds have, in many cases, been the cause of unnecessary tool wear, and are therefore not economical.

Simple Formulas for Obtuse-Angled Triangles

By FRED G. KENYON, Tool and Gage Designer
Springfield, Mass.

When the lengths of all three sides of an obtuse-angled triangle are known, a set of formulas may be applied which are quite simple and which are not generally given in handbooks. Referring to the accompanying illustration, let a, b, and c be the respective lengths of the three sides of the triangle. It is desired to find the angles.



Notation Used in Formulas for Solving Obtuse-angled Triangle

Drop a perpendicular from the apex of angle A to the base BC; assume that $m - n = x$; then x may be found from the following equation:

$$\frac{a}{b+c} = \frac{b-c}{x}$$

When x is known, m and n may be found as follows:

$$m = \frac{a+x}{2}\,; \quad n = \frac{a-x}{2}$$

With m and n known, the angles in the two triangles ABD and ACD and angles BAD and CAD are easily found, since these are right-angled triangles.

That the formulas given are correct may be easily proved as follows (see illustration):

$$m + n = a; \quad m - n = x$$

$$y^2 + n^2 = c^2; \quad y^2 + m^2 = b^2$$

Subtracting the two last equations one from the other, we have:

$$m^2 - n^2 = b^2 - c^2, \text{ or}$$

$$(m + n)\ (m - n) = (b + c)\ (b - c),$$

$$\frac{m+n}{b+c} = \frac{b-c}{m-n}$$

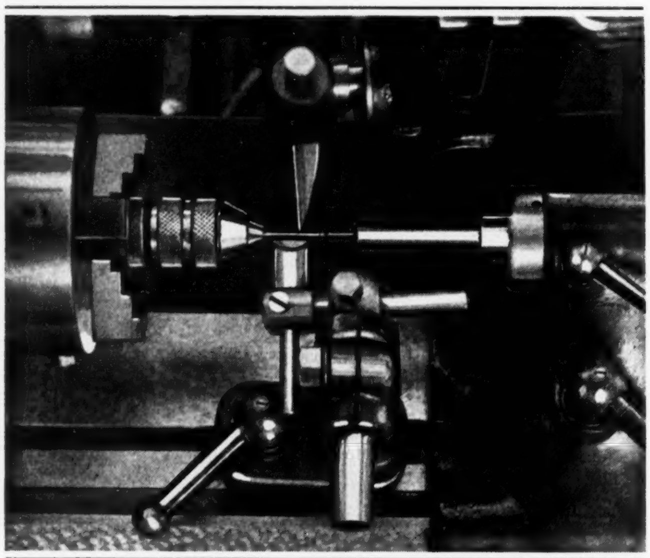
Substituting values of a and x,

$$\frac{a}{b+c} = \frac{b-c}{x}$$

Grinding Cobalt Wire to a Diameter of One-Half Millimeter

By O. S. MARSHALL

The success of some important experiments depended on finishing, to close limits of accuracy, a wire 1/2 millimeter in diameter by 23 millimeters long. It was necessary to make this wire from a 3/32-inch square cobalt bar 1 1/2 inches long. The procedure followed in machining this delicate wire is described in the following: The ends of the bar were first hand-ground to a conical shape having an included angle of 60 degrees. The bar was then held at one end in a small drill chuck secured to the regular three-jaw chuck of a universal tool grinder. The other end of the bar was supported by a recessed center held in the grinder tailstock.



Set-up Used for Accurate Grinding Operations on Delicate Cobalt Wire

The jaws of the drill chuck were adjusted to grip the left end of the cobalt bar, making contact on the conical part previously hand-ground. The bar was then adjusted until it ran approximately true, the jaws of the drill chuck serving both to support and drive the work. The wheel used to grind the work to a cylindrical shape between the ends is shown above and to the rear of the work. It has a 1/16-inch face and performs the cylindrical grinding operation with the work supported only at the ends. This operation left the two conical ends with a short straight portion untouched. Care was taken to grind the bar parallel within 0.001 inch.

The conical center at the drill chuck end and the untouched portion were next ground away and the remaining cylindrical end held in a collet made for the purpose, a set-screw being used to clamp the collet on the work. Care was taken to insure true running of the collet, so that it could be used for holding the wire during subsequent lapping with a fine oilstone.

The next step was to provide a spring support for the final grinding of the wire to the required diameter. As no regular steadyrest was furnished with the grinder, one was improvised, as shown in the illustration, making use of the diamond truing holder. The joint construction of this device made it a simple matter to locate one of the members in the proper position to serve as a work-support. The wire-supporting member was in two parts, the wire contacting part being backed up by a coil spring which exerted a light pressure against the work. A 60-degree shallow groove was carefully milled in the supporting head as a seat or saddle for the wire. The width of this support was about equal to the length of the finished portion of the wire. The supporting member was carefully adjusted to maintain proper support for the work, the spring tension taking care of the gradual reduction in the wire diameter. Great care was required in setting the tailstock to provide a definite support for the work without causing it to buckle. This was guarded against by using a sensitive indicator on the wire in setting the tailstock.

The wire was ground to within 0.0005 inch of the required size, and then brought to the exact size and given the required finish with a fine-grain oilstone, using an accurate flat-surfaced bar as a work-support. This bar was carefully adjusted to support the wire from the under side while running the work at top speed. During this operation, the wire was supported at the two ends.

* * *

Savings Due to Using Welded Fixtures

In one plant, from two to three weeks' time is being saved in the production of large jigs and fixtures by employing arc-welded construction. Because of the cheapness of arc-welded jigs and fixtures, it is economical to build many fixtures for small production, the cost of which would have been prohibitive before the introduction of this method of construction. Very large jigs of this type are being made. For example, one manufacturer has constructed arc-welded jigs for drilling milling machine bases. In order to make the greatest saving possible in tool costs, the structural steel shapes available on the market should be employed.

* * *

General Electric Establishes Safety Record

Not one fatal accident from an occupational cause was suffered by any employe of the General Electric Co. during 1935, according to a report recently compiled by the company's safety committee. The report also shows that apparently safety consciousness, instilled at work, carries on after the whistle blows, for among the company's employes there were also the fewest number of accidents outside of work hours for any year on record.

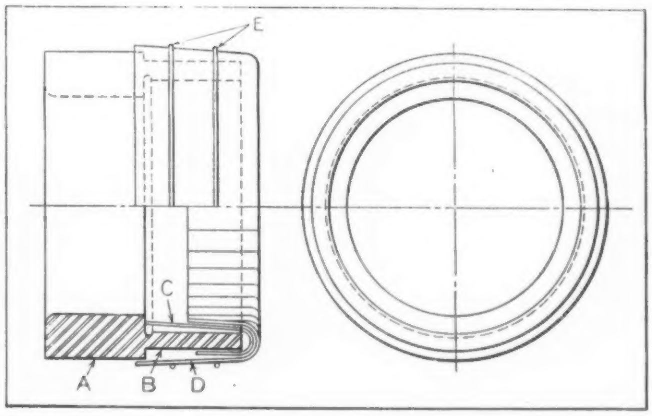
Shielding Thin Sections of Punch to Reduce Hardening Strains

By W. T. KOEHLER

In hardening parts the cross-sectional area of which varies considerably, as in the case of the punch-ring *A* shown in the illustration, considerable skill is required to prevent the thin section *B* from cracking or breaking away from the heavier section. This particular piece could be redesigned to reduce the hardening strains, but in the form shown it serves to illustrate the value of shielding thin sections and sharp corners that are not required to be file hard. The heat-treatment of the part shown was not always successful, even when the greatest care was used. The punch-rings that did not break in hardening often failed in service, unless they were drawn at fairly high temperatures, which reduced their wearing qualities.

By shielding the thin section with metal shields *C* and *D*, as shown in the illustration, the punch-ring could be hardened in brine and oil with freedom from breakage. This favorable condition results from steam forming under the shields which, in turn, prevents the cold water from coming directly in contact with the metal, thereby slowing the cooling action of the water upon the thin section and the sharp corners that are shielded, leaving these parts tough but not file hard. This method can only be used where there are no objections to leaving the thin sections in the toughened condition. Heavy sections should never be shielded and thin sections left unshielded for hardening, as this would increase the liability of cracking.

The shields are made of light sheet iron or tin plate, about 0.010 inch thick, the ends being slit so that they can be folded or bent over, as indicated. Wires *E* hold the shields in place.



Punch-ring with Sheet-metal Shields Used to Prevent Cracking when Hardening

The actual procedure in hardening the punch-rings, which are made of 1 per cent carbon, water-hardening steel, is as follows: First, shield the thin sections and sharp corners as shown, and then heat the work to about 1420 degrees F., dip in brine for three seconds, then place in oil until cool, finally drawing in oil at 375 degrees F. for one hour.

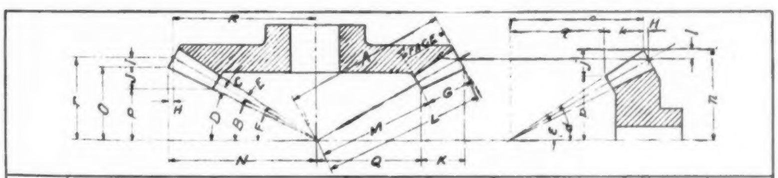
* * *

Chart for Bevel Gear Calculations

By HENRY R. BOWMAN

A chart arranged as shown in the accompanying illustration has been found to be a great time-saver in computing bevel gears. Every step is given in its natural sequence, and it is unnecessary to refer to a handbook. A book of logarithmic tables is all that is required, preferably reading to seven places and angles to seconds.

The writer uses a white- or red-line print on which the logarithms and their corresponding numbers can be entered in pencil in the blank spaces, and added or subtracted as indicated. The print can then be filed for future reference. The idea can be applied to other computations.



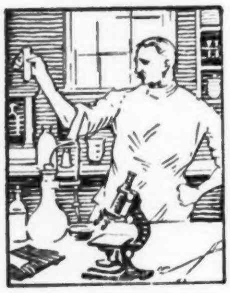
	LOG.	CORR. NO.		LOG.	CORR. NO.		LOG	CORR. NO.
r			TAN B = r/R			O = L x SIN D		
R			A = R/COS B			P = M x SIN D		
ADD.			TAN C = ADD./A			Q = M x COS D		
DED.			D = B − C			d = B + C		
FACE			TAN E = DED./A			E = B E		
TAN B			F = B + E			o = L x COS d		
COS B			G = FACE/COS C			n = L x SIN d		
SIN B			H = ADD x SIN B			p = M x SIN d		
TAN C			I = ADD x COS B			q = M x COS d		
COS C			J = G x SIN D			k = G x COS d		
SIN C			K = G x COS D			j = G x SIN d		
TAN D			L = A/COS C			DED. = 2.157/DP − ADD		
COS D			M = L − G			x = SIN (90°/N) r y = A/TAN (90° − B)		
SIN D			N = L x COS D			b = SIN x/y Z = y cos b	CORRECED ADD. = 1/DP + y − Z	

Chart Used to Simplify Bevel Gear Calculations

* * *

Our real problem is to raise the standard of living. The living standard is raised when plenty of goods are available at reasonable prices. There is only one way to keep prices reasonable, and that is by the production of more commodities with the same expenditure of time and money; this, in turn, can be done only by the use of the most highly improved machine equipment.

MATERIALS OF INDUSTRY



THE PROPERTIES AND NEW APPLICATIONS OF MATERIALS USED IN THE MECHANICAL INDUSTRIES

A Metal Finish Unmarred by Drawing Operations

A synthetic coating for metals that is sufficiently adherent and elastic to permit bending, drawing, and other press operations to be performed without marring or cracking the finish has been developed by the Bradley & Vrooman Co., 2629-2635 S. Dearborn St., Chicago, Ill. This coating, which is known as Sterilkote, is obtainable clear and in a variety of colors. It hardens with a glossy appearance.

Sterilkote is applied to metal by spraying or by roller-coating, and is then baked at temperatures and for periods of time that depend upon the requirements of the work. The coating is recommended especially for lining beverage and food conveyors, since it is non-toxic, odorless, tasteless, and non-porous. It is also recommended for use on metal surfaces that are subjected to hard usage, such as washing-machine lids, special types of dispensing cabinets, and laboratory equipment.

Extremely Thin Sections in Die-Castings

Among the striking advances made during recent years in the art of die-casting, one of the most important is the ability to produce parts with extremely thin sections. The illustration shows a small elbow casting in which the wall thickness varies from 0.015 to 0.0175 inch—approximately only 1/64 inch.

This example also emphasizes the practicability of die-casting threads sufficiently accurate not to require a finishing operation, except for removing the slight flash at the parting line in a trimming die. United States Form threads of twenty-four per inch are cast on the part shown. The pitch diameter is slightly under size, as a free fit with the nut is permissible.

This part is cast from zinc by the Schultz Die-Casting Co., Toledo, Ohio, at a pressure of 1600 pounds per square inch, which is the standard pressure employed by the concern for small or large die-castings and for thin or heavy sections. The elbow casting measures approximately 1 1/2 inches over all. It has a 7/8-inch hole in one end and a 9/16-inch hole in the other end. After being cast and trimmed, this part is chromium-plated.

The Navy is the Biggest User of Stainless Steel

Figures recently issued by the American Iron & Steel Institute show that the United States Navy is the biggest consumer of stainless steel. This material has been a boon to the Navy in meeting weight-limitation programs, because it enables the desired strength to be obtained with a minimum amount of material. As stainless steel is rust-resisting, it is possible to avoid considerable dead weight, previously required to guard against the loss of strength by parts rusting and thus decreasing in thickness.

Nine different types of stainless steel are used in large quantities by the Navy. In addition to the major applications where weight and strength are

Zinc Die-casting with a Wall Thickness of Only 1/64 Inch

important factors, stainless steel is employed for many small fittings and parts, such as engine parts, steering transmission shafts, hinge-pins for doors, and davit fittings.

The messrooms of our battleships are now being equipped with knives, forks, and spoons of stainless steel, and the same metal is being used extensively on board ship for laundry machinery and food-handling equipment.

Nickel Silver Made by the Chinese Long Before the Christian Era

The Chinese, inventors of gunpowder and the printing press, were also pioneers in the alloying of metal. Hundreds of years before our era they combined zinc with the nickel-copper ores found in Yunnan Province, according to "The Story of Nickel," to obtain nickel silver. Even as early as 200 B.C. this alloy, which was called paktong, or white copper, was an article of export. It was sent from China in caravans across mountains and deserts to distant Persia.

By the beginning of the eighteenth century, paktong was such a popular substitute for silver throughout the civilized world that the mines of Yunnan could no longer supply the demand, and copper-nickel ore was shipped from Litchfield County, Conn., to China to be made into paktong. It took Occidental scientists fifty years to find the secret of this Oriental metal, which today is a common household alloy.

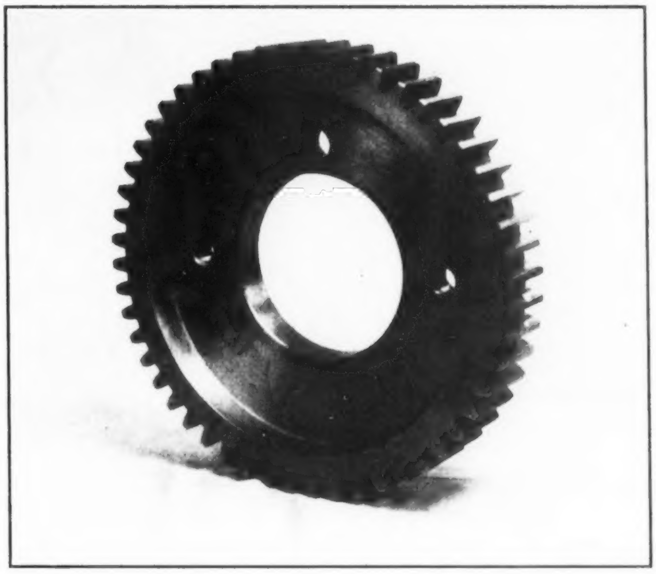
Synthetic Rubber Used in Airplane Fuel Lines

The excellent results obtained during extensive experiments have led the United States Army Air Corps to adopt DuPrene as the standard material for lining fuel-line connections on airplanes, and also for radiator connections on airplanes that are water-cooled. In the experiments, this synthetic rubber, which is a product of E. I. du Pont de Nemours & Co., Wilmington, Del., was found to resist deterioration by oil and greases. It was also found to be unaffected by anti-freeze solutions in water-cooled motors.

A manufacturer of mechanical seals has found that the resistance of DuPrene to the effects of heat, gasoline, oils, greases, and refrigerants has made this material especially desirable for use on rotating shafts.

Chrome-Molybdenum Steel Obviates a Gear-Grinding Operation

The former practice of the Faitoute Iron & Steel Co., Newark, N. J., was to grind the teeth of the gear here illustrated after heat-treatment, so as to eliminate warpage. It was found, however, that by making the gears from S A E 4150 chromium-molybdenum steel, grinding was unnecessary, as distortion due to heat-treatment was negligible.



The Adoption of Chromium-molybdenum Steel has Eliminated a Tooth-grinding Operation in the Manufacture of this Gear

These gears must have a tooth hardness of from 75 to 80 scleroscope. The gears are 9 inches outside diameter, 1 1/2 inches face width, and 3/4 inch web thickness. There are fifty-two teeth.

The small amount of inaccuracy in the teeth after heat-treatment is rather unusual, in view of the abrupt change in the web and face sections.

Capacity of Buses Increased by Using Nickel Steels

Buses operated on the highways of Great Britain have been redesigned to increase the capacity without exceeding weight limitations fixed by law. According to the *Nickel Bulletin*, which is published in London, a saving of approximately 16 per cent in the dead weight of buses per passenger accommodation has been effected by the extensive use of nickel alloy steels. These stronger steels have permitted substantial reductions in the size and weight of gears, shafts, and chassis members.

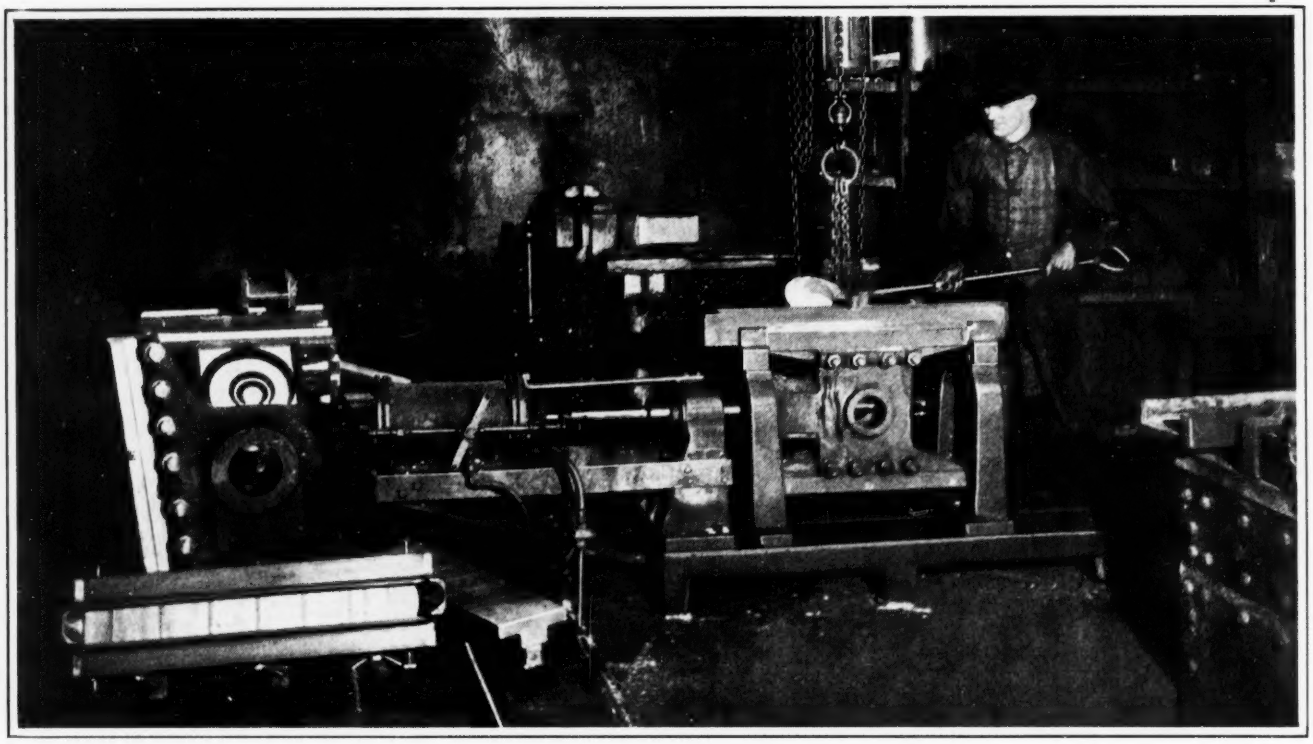


Fig. 1. The Use of Jigs in Babbitting Locomotive Cross-heads, Cross-head Slippers and T-shaped Guides has Eliminated the Need of Machining the Babbitted Surfaces

Use of Babbitting Jigs Saves Machining

By OLIVER HERBERT

THE use of jigs in babbitting locomotive cross-heads, cross-head slippers, and T-shaped cross-head guides in the Battle Creek, Mich., shops of the Grand Trunk Railway System has eliminated the need of machining the babbitted surfaces of these parts. Sectional cast-iron jigs are used, and their machined surfaces produce smooth babbitted surfaces on the work, the dimensions of which are within the desired limits. When the babbitt has solidified, the jigs can be taken

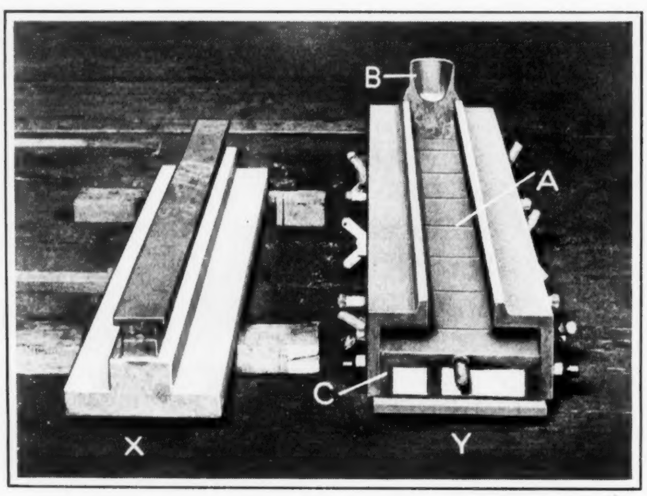


Fig. 2. T-shaped Locomotive Cross-head Guide, and Jig which Gives Smooth Babbitted Surfaces within Desired Dimensional Limits

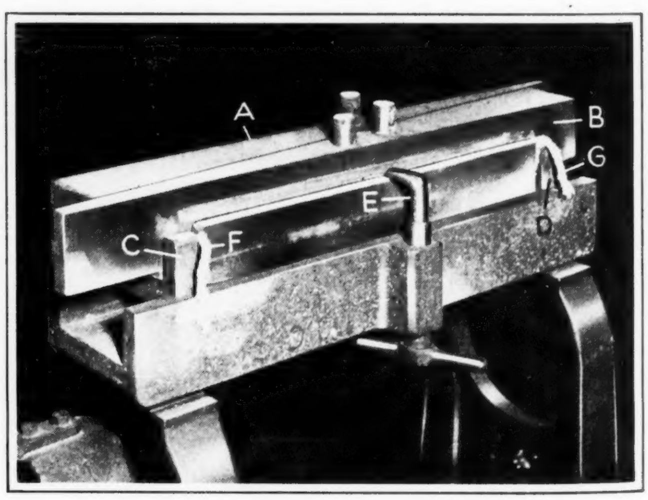


Fig. 3. Wedge-shaped Blocks Overcome Difficulties from Shrinkage as the Cross-head Slippers Cool after the Babbitting Operation

apart, thus permitting the work to be easily removed from them.

At *X*, Fig. 2, is shown a typical T-shaped cross-head guide, and at *Y* the jig used in babbitting the major portion of its surfaces. The guide proper is a steel casting. It is placed in the jig with a clearance of 1/8 inch all around the surfaces to be babbitted. The bottom of the guide casting rests on studs, so as to be clear of the mold floor the required amount. The floor has a series of transverse ridges *A* in it which produce oil-grooves in the guide.

It will be understood that the illustration shows this jig with one end removed. With the cross-head guide in place, an end similar to that at *B* is assembled on the end shown exposed, and then the babbitt is poured from both ends. Block *C* is cored for lightness. Assembling and disassembling of this jig requires but a few moments.

In Fig. 3 is shown the set-up employed in babbitting the cross-head slippers, which are channel-shaped and of different widths. The babbitt on the channel surfaces is formed by two wedge-shaped iron castings *A* and *B*, which are held in alignment with each other by means of a tongue and groove. Blocks *C* and *D* support the wedges at the desired height above the slipper and center them in the jig. To allow for expansion, the main jig casting is machined wider than the slipper. Two set-screws force the slipper against the side of the jig, after which a clamp *E* on each side is tightened to keep the slipper from shifting.

Wedges are used in this operation because the slippers shrink in cooling after the babbitt has been poured. If a solid block were employed, it could be removed only with difficulty, but the wedges slide out readily when tapped on one end. The babbitt is poured into the mold through the openings that run along each side between the wedges and the slipper. Asbestos rope at the ends, as seen at *F* and *G*, prevents the babbitt from running out of the mold.

Babbitting operations on the slide surfaces of cross-heads are performed in much the same manner as the babbitting of the slipper, as will be apparent from Fig. 1. This operation is performed while the cross-head is mounted in air-actuated equipment that is employed for centralizing the slipper with the X-head fit.

* * *

The fact seems to have been overlooked that in its economic progress from handicraft to mechanized production, industry unconsciously shifted "costing" over into the field of engineering. The further fact that neither accountancy nor industry has generally recognized this change is responsible for both the present dearth of practical cost systems in industry, and the failure of the agencies heretofore charged with the task of solving this industrial problem.—*Robert Scudder Denham*

Attention to Small Things May Change Failure to Success

By VERNON E. DAVIS

Frequently the reason why a shop is unable to compete with other shops is due to poor machine equipment, poor tools, or lack of attention to their proper upkeep. In one shop, the gear-cutting machines were producing much less than those employed in other plants. No special attention had been paid to them or to the amount of work turned out. The foreman eventually started to check up on them to see what could be done to increase their production. In this case, the machines were found to be in the best of repair. An examination of the chips, however, showed that they really were not chips at all, but rather a coarse dust. The cutters were running fast enough, but they did not run true; frequently they had one or more high teeth.

After having seen to it that the cutters were running true and that they were properly sharpened, the teeth of the cutters were counted, and the feed set at 0.015 inch per tooth. This attention to a small detail increased production over 100 per cent without sacrifice of quality. In one size of gear, in fact, the output was trebled. To obtain these results, it was necessary to have the bearings as tight as practicable and the work-support as close to the work as possible.

The milling machines were then studied, and the same trouble was found on most milling jobs. By grinding the cutters true and running them true when on the arbor, in addition to setting the feed at a figure most suitable for the work, the quality was maintained, while the production was more than doubled. The only investment made was in the care taken in grinding the cutters and in the adjustment of the bearings of the machines.

In another instance, the lathes were old and of light construction. They were always breaking down if they were pushed hard enough to produce a fair day's work. Of these lathes, four were scrapped and three new ones installed in their place. These three machines turned out more and better work than five old lathes had been doing.

The improved production in this shop resulted in increased pay for the men, lower costs and reduced selling prices, bigger volume of orders, and increased profits. All the work was on an hourly basis. There was no inspection until the work reached the assembly floor, and yet there was hardly any spoiled work.

* * *

Industry—manufacturing—is not our principal means of livelihood. Industry will never be able to employ the whole people. The place of industry is not to provide people with their living, but to provide them with the things they use in getting a living.—*Henry Ford*

NEW TRADE LITERATURE

Recent Publications on Machine Shop Equipment, Unit Parts, and Materials. Copies can be Obtained by Writing Directly to the Manufacturer.

Ball Bearings and Heavy-Duty Roller Bearings

FAFNIR BEARING CO., New Britain, Conn. Engineering Manual No. 35, containing 197 pages of data covering the selection, application, and operation of anti-friction bearings, with particular reference to ball bearings. The book contains much information of value to machine designers and production engineers, such as load formulas for belt drives, chain and rope drives, spur gears, bevel and helical gears, worm gears, etc.; and a complete tabulation of bearing characteristics, dimensions, and capacities. Those responsible for machine assembly and operation will be especially interested in Section 4, which deals with shaft fitting methods, housing and mounting instructions, and lubrication. Another section of the book contains complete data on the Fafnir line of radial and thrust ball bearings; wide inner-ring ball bearings and power-transmission units; and industrial roller bearings. The new manual is available without charge to executives and engineers responsible for bearing selection or maintenance.

Silent Chain Drives

RAMSEY CHAIN CO., INC., Albany, N. Y. Booklet entitled "The A B C of Silent Chain Drives," containing important facts on this type of drive —its special advantages, construction, operation, performance, and lubrication and care. Those who are confronted with transmission problems or designers who have to choose the type of drive that will best meet the given conditions will find it worth while to study the data on silent chain drives here presented.

Boring-Bars

MCCROSKY TOOL CORPORATION, 1340 Main St., Meadville, Pa. Bulletin 15-B, illustrating and describing the exclusive features and advantages of McCrosky block type adjustable boring-bars with centralizing V-lock. The bulletin explains how the block is centered and locked in the bar and how it is removed without removing the key. Dimensions and prices are given for the roughing, finishing, and extended styles of blocks and for the standard boring-bars.

Lathes

LODGE & SHIPLEY MACHINE TOOL CO., Cincinnati, Ohio. Bulletin entitled "Examples of Turning," containing complete details and specifications of all sizes of Lodge & Shipley manufacturing lathes, designed to combine the production possibilities of an automatic with the flexibility of an engine lathe. Ten pages of the bulletin contain illustrations showing tool set-ups used on typical jobs for which these lathes are particularly adapted.

Speed Reducers

FOOTE BROS. GEAR & MACHINE CO., 5301 Southwestern Blvd., Chicago, Ill. Handbook of worm-gearing and "Hygrade" worm-gear speed reducers. The first part of the book covers the early history and development of worm-gearing and gives information on the selection and efficiency of speed reducers. The book also shows various applications of "Hygrade" speed reducers and contains tables of dimensions covering the complete line.

Ball Bearings

BEARINGS CO. OF AMERICA, Lancaster, Pa. New ball bearing engineering data book, containing dimensions, load ratings, etc., for all sizes and types of ball bearings, as well as simplified tables for the easy interpolation of loads at in-between speeds. There are also complete descriptions of new prelubrication and enclosure features. Copies of this book will be supplied without charge to plant superintendents, engineers, and draftsmen.

Metal-Cutting Saws

HENRY DISSTON & SONS, INC., 406 Tacony, Philadelphia, Pa. Booklet entitled "Inserted-Tooth Metal-Cutting Saws—Their Selection and Care," illustrating and describing methods of holding teeth in saws and containing data on types of saws to employ for various cut-off machines in general use, rules for obtaining the best results in operation, and instructions for grinding teeth and for inserting teeth in saws.

Power-Transmission Equipment

W. A. JONES FOUNDRY & MACHINE CO., 4401 Roosevelt Road, Chicago, Ill. Catalogue illustrating and describing the principal products made by this concern, which include gears and geared speed reducers, pillow blocks and bearing units, V-belt sheaves, friction clutches, and pulleys. A number of typical applications and some of the precision methods used are shown.

Metal-Spraying Equipment

METALS COATING CO. OF AMERICA, 495 N. Third St., Philadelphia, Pa. Folders 1203 and 1204, describing the MetaLayer spraying system for simultaneously melting, atomizing, and spraying coatings of any metal on any surface. The Hi-Cap MetaLayer spraying and blast cleaning equipment is also described, as well as a mass coating machine.

Phosphor-Bronze Bearings

JOHNSON BRONZE CO., 520 S. Mill St., New Castle, Pa. Catalogue listing the complete line of phosphor-bronze general-purpose bearings and bushings made by this concern. A feature of the catalogue is an alphabetical list of electric motor service bearings, arranged according to the names of the motors for which these bearings are intended.

Precision Gage-Blocks

JOHANSSON DIVISION OF FORD MOTOR CO., Dearborn, Mich. Leaflet giving the sizes of Johansson gage-blocks in Set No. 2, which consists of thirty-five blocks and four accessories, by means of which 80,000 different size gages in steps of 0.0001 inch can be made. The circular also illustrates a few of the many uses of this Johansson gage set.

Smoke-Density Recorders

LEEDS & NORTHRUP CO., 4921 Stenton Ave., Philadelphia, Pa. Electrical equipment which measures smoke density at the stack, indicates and records it wherever needed, and signals major changes if desired, is described in a catalogue on Leeds & Northrup Micromax smoke-density recorders.

Roller Bearings

TIMKEN ROLLER BEARING CO., Canton, Ohio. Crane Supplement to the Timken Engineering Journal, illustrating typical lay-outs for the application of Timken tapered roller bearings in all types of crane machinery. The information given includes data on bearing selection, fitting practices, closures, and assembly.

Tapping Machines

WESTERN MACHINE TOOL WORKS, Holland, Mich. Catalogue 9700, illustrating and describing Garvin No. 2-X automatic tapping machines equipped with Timken tapered roller bearings. The various models are shown by large-scale halftones, and different drive arrangements are illustrated.

Roller Bearings

MCGILL MFG. CO., Valparaiso, Ind. Bulletin 36, describing the features of design of McGill Multirol bearings, which are made in two types —the full type roller bearing and the cam follower roller bearing. In addition to the design data, standard sizes are listed and typical applications are illustrated.

Polishing Wheels and Sanding Equipment

PRATT & WHITNEY CO., Hartford, Conn. Circular S-454, containing data, including prices, on Keller expanding rubber polishing wheels and sanding drums, as well as information on Keller abrasive belts and sleeves.

Gear Shapers

FELLOWS GEAR SHAPER CO., Springfield, Vt. Circular illustrating and describing the Fellows 7A type special high-speed gear shaper equipped with gap type roughing and finishing cutters for roughing and finishing gears in one operation. Complete specifications are included.

Rotary Shears

NIAGARA MACHINE & TOOL WORKS, 637-697 Northland Ave., Buffalo, N. Y. Bulletin 70-C, covering the complete line of Niagara machines for cutting circles and rings and for slitting and flanging. Complete specifications for the different machines are included.

Degreasing Machines and Solvents

DETROIT REX PRODUCTS CO., 13005 Hillview Ave., Detroit, Mich. Circular illustrating several styles of degreasing machines made by this concern. Brief information is given on "Perm-A-Clor" and "Triad" solvent cleaners.

Precision Bench Lathes

SOUTH BEND LATHE WORKS, 720 E. Madison St., South Bend, Ind. Bulletin 7, illustrating and describing the South Bend 1936 model 9-inch "Workshop" precision lathe for use in machine shops, automotive repair shops, laboratories, school shops, etc.

Indicating and Recording Instruments

BRISTOL CO., Waterbury, Conn. Circular describing the important features of the Bristol wide-strip pyrometer, which is self-balancing, self-standardizing, and self-compensating for cold-junction temperature changes.

Blueprinting Machines

C. F. PEASE CO., 813 N. Franklin St., Chicago, Ill. Circular describing the outstanding features of the new Pease Model 7 mercury vapor tube blueprinting machine, a machine designed to provide continuous printing of moderate requirements at low cost.

Shapers

WESTERN MACHINE TOOL WORKS, Holland, Mich. Catalogue 130, covering the Steptoe line of shapers. The important features of construction of these machines are described and full-page halftone and line illustrations show the various types or models.

Conveying and Power-Transmitting Machinery

PALMER-BEE CO., Detroit, Mich. Section 111 of general catalogue 100, containing data on the line of skip hoist and drag-line machinery made by this company for use in elevating and conveying installations.

Zinc-Base Die-Cast Alloys

APEX SMELTING CO., 2554 Fillmore St., Chicago, Ill. Metalgram No. 5, giving a summary of the physical properties of zinc-base die-cast alloy No. 2 when cast at different metal and die temperatures, and different pressures.

Optical Pyrometers

PYROMETER INSTRUMENT CO., 103 Lafayette St., New York City. Catalogue 70, describing the unique features of a simplified optical pyrometer known as the "Pyro," which is a self-contained direct-reading precision instrument.

Laboratory Equipment

BAUSCH & LOMB OPTICAL CO., Rochester, N. Y. Bulletin D-119, containing data on microscope lamps for routine and research work. Folder descriptive of the Bausch & Lomb spectrum measuring microscope.

Corrosion-Resisting Iron

REPUBLIC STEEL CORPORATION, Cleveland, Ohio. Circular entitled "Here's a Double-Edged Sword to Help You Cut Air-Conditioning Costs," illustrating the use of Toncan iron in air-conditioning equipment.

Dust-Collecting and Cleaning Equipment

PANGBORN CORPORATION, Hagerstown, Md. Circular entitled "Why Pay Tribute to Demon Dust?" illustrating and briefly describing Pangborn dust collectors for industrial use.

Pipe Machines

BEAVER PIPE TOOLS, INC., Warren, Ohio. Circular illustrating and describing the Beaver Model A special pipe machine for cutting, threading, reaming, and chamfering pipe from 1/8 inch to 2 inches.

Nickel-Clad Steel

LUKENS STEEL Co., Coatesville, Pa. Bulletin T-4, describing the methods employed in fabricating Lukens Nickel-Clad steel. Considerable attention is given to the methods used in welding this steel.

Electric Furnaces

HAROLD E. TRENT Co., 618 N. 54th St., Philadelphia, Pa. Loose-leaf circular descriptive of Types B and BA electric furnaces, and thermometer and thermo-couple calibration tanks and furnaces.

Screw Machine Accessories

SUTTON TOOL Co., 2842 W. Grand Blvd., Detroit, Mich. Catalogue 12, covering this company's line of accessories for automatic and hand screw machines, including collets and feed-fingers.

Testmotors

A. G. REDMOND Co., Flint, Mich. Circular announcing a small alternating-current motor known as the Testmotor, equipped with gear reductions, for laboratory testing.

Material-Handling Equipment

AMERICAN MONORAIL Co., 13107 Athens Ave., Cleveland, Ohio. Catalogue descriptive of the American Mono Tractor, an electric drive unit for Monorail material-handling systems.

Electric Equipment

GENERAL ELECTRIC Co., Schenectady, N. Y. Circular GEA-2273, illustrating and describing the GE inkless cycle recorder for measuring short intervals of time in alternating-current resistance welding.

Welding Machines

OWEN-DYNETO CORPORATION, Syracuse, N. Y. Circular illustrating and describing the USL "Protected Arc" welders, which are manufactured in both portable and stationary designs.

Material-Handling Equipment

CHAIN BELT Co., Milwaukee, Wis. Bulletin 266, descriptive of Rex-Stearns Timken idlers and their application in material-handling equipment in different industries.

Lift and Floor Trucks

LEWIS-SHEPARD Co., 245 Walnut St., Watertown, Mass. Circular 317, devoted to factory and warehouse floor trucks and lift trucks equipped with rubber-tired wheels.

Portable Electric Tools

CHICAGO PNEUMATIC TOOL Co., 6 E. 44th St., New York City. Catalogue 900, covering an entirely new line of portable electric tools known as "Hicycle," including drills, reamers, screwdrivers, tappers, grinders, etc.

Automatic Screwdrivers

FORSBERG MFG. Co., Bridgeport, Conn. Circular descriptive of the new Whale automatic screwdriver, which is designed to combine light weight and strength.

Precision Grinders

DUMORE Co., Racine, Wis. Leaflet illustrating and describing the new Dumore No. 44 "Toolmaker," a small precision grinder applicable for use on lathes.

Heat-Treating Equipment

LINDBERG ENGINEERING Co., 221 Union Park Court, Chicago, Ill. Bulletin 51, describing the new Lindberg gas-fired Cyclone tempering furnace.

Plating Machines

UDYLITE Co., Detroit, Mich. Circular illustrating and describing the details of the Udylite semi-automatic plating machine.

Taylor & Fenn Co. Completes a Century of Machine Tool Building

The Taylor & Fenn Co., manufacturer of machine tools, Hartford, Conn., has published a book entitled "A Century of Machine Tools," commemorating the fact that the company has been in business over 100 years. The business was founded in 1834 by Levi Lincoln and has been in continuous operation for over a century in the same line of work. What is more remarkable is that the business has been conducted on the same site where it was originally started so many years ago. It has been known as Lincoln & Co., the Phoenix Iron Works, and since 1907, as the Taylor & Fenn Co.

At first this company manufactured a machine for setting wire teeth in cards. Later a machine was made for making hooks and eyes. This form of fastener became very popular and the business grew rapidly. By 1855, the plant was making various types of all the machine tools of that time—lathes, planers, punch presses, milling machines, gear-cutting machines, and drilling machines. This phase of the company's development was particularly associated with the firearms industry, for it supplied much of the machinery installed in the Colt factory and helped to equip the armories in the north during the Civil War.

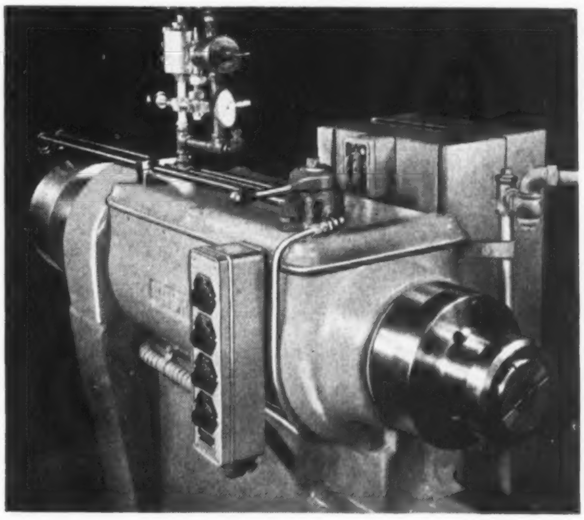
The Lincoln milling machine first built for armory work came to be a well-known product of the company, and this type of machine is known as the Lincoln type to this day. Joseph W. Roe, in "English and American Tool Builders," (1916) says of this machine: "Few machines have changed so little or have been used so widely. It is said that more than 150,000 of them have been built in this country and abroad. Even in Europe the type is definitely known by this name."

The old order books show that, in 1861, one hundred Lincoln milling machines were sold to the Colt plant, and in 1872, sixty-five of these machines were sold to Ludwig Loewe & Co., Berlin, Germany, for a Prussian government armory. As an evidence of the good workmanship of the machines turned out by the company, it is mentioned that in 1865, a 17-inch screw-cutting lathe was sold to Case, Lockwood & Co., and that this machine, after continuous service for seventy years, is still in use.

* * *

Artificial abrasives, such as aluminum-oxide and silicon-carbide, or the natural abrasive garnet, are now being coated on paper, cloth, or combination backings by a process that embeds the abrasive grains in the backing with all the cutting points turned upward, so that the maximum number of cutting edges are presented to the surface to be finished. The process also distributes the abrasive grains evenly over the backing. It is stated that the new coated abrasives have an increased efficiency of 20 to 60 per cent. They are available in forms to fit standard power and hand tools, as well as in sheets.

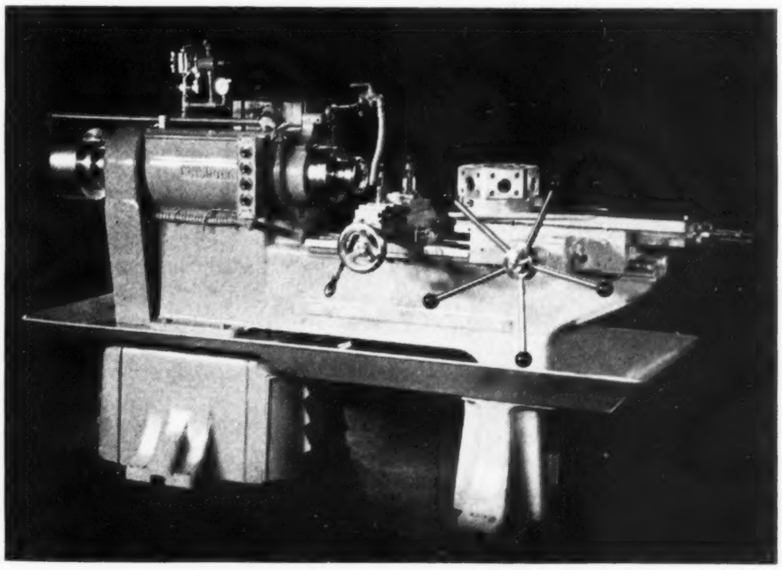
Shop Equipment News



Machine Tools, Unit Mechanisms, Machine Parts, and Material-Handling Appliances Recently Placed on the Market

Gisholt 18-Inch High-Speed Turret Lathe

A simplified high-speed turret lathe developed for handling a wide range of ferrous and non-ferrous metals in both large-quantity and small-lot production has recently been announced by the Gisholt Machine Co., 1209 E. Washington Ave., Madison, Wis. This machine is of the same general design as the Nos. 3, 4, and 5 universal turret lathes built by the company, and it embodies many of the same automatic labor-saving devices. The automatic collet has a chucking capacity for round, hexagonal, and square stock of 1 1/2, 1 3/8, and 1 1/8 inches, respectively. Either an 8-, 10-, or 12-inch scroll chuck can be applied. The machine has a maximum swing of 18 1/2 inches over the ways.



Gisholt High-speed Turret Lathe Designed for Large-quantity and Small-lot Production

An unusual feature of this machine is that all gears and clutches have been omitted from the spindle and headstock. The spindle is mounted in tapered roller bearings, and is driven by V-belts direct from a motor mounted in the cabinet under the headstock. These belts drive an aluminum sheave located on the spindle in back of the rear bearing. The sheave is so mounted that it can be quickly replaced by another of different diameter, thus permitting the speed to be varied in much the same manner as is accomplished with pick-off gears. A corresponding change is made in the motor pulley. An adjustment of the motor mounting compensates for differences in the center distances between the motor pulley and the spindle sheave. A motor sheave of variable diameter can also be supplied.

By means of this drive, the correct speed can be obtained for any desired work diameter. It also minimizes the inflexibility of two- or four-speed motors.

The spindle is controlled by means of a push-button panel on the headstock, as seen in the heading illustration. Different buttons provide for starting, stopping, and reversing the motor, and for obtaining the different motor speeds.

The hexagon turret and its stop roll are automatically indexed to the next position with each return movement of the slide. When the slide advances to the work, the hexagon turret is automatically located and clamped in place. The machine is also available with a power-feed or hand-feed turret. The saddle may be clamped to the bed in any position. Hardened steel bed-ways, clamps, tapered gibs and slide-ways insure alignment over a long period of time.

Three types of hand-operated cross-slides are available, with or without a hand longitudinal adjustment. These cross-slides can be operated by a lever or screw or by a combination of both. An under-cut forming attachment may be furnished to permit the use of skiving tools. The cross-slides are equipped with adjustable stops.

The bed and headstock are cast integral from nickel semi-steel. The spindle bearings of this turret lathe are automatically lubricated with filtered oil from the headstock well. The turret-slide is equipped with a one-shot pressure system which forces oil through the saddle to the slide bearings. The oil is held in a reservoir which is entirely enclosed, so that clean oil is constantly supplied. Various types of work-holding equipment can be readily attached to the machine. A bar feed may be applied and a coolant pan and pump may be provided.

Fellows Gear Shaper with Gap Type Cutters

A special gear shaper recently placed on the market by the Fellows Gear Shaper Co., Springfield, Vt., roughs and finishes gear teeth with the same cutter in one operation. The removal of stock is divided between roughing and finishing sets of teeth. During the entire operation, the position of the saddle remains the same, thus insuring a positive control of the size. The machine eliminates one handling and also reduces the cutting time, with the result that production rates are increased about one-third over the conventional type of gear shaper. Total costs are decreased, due to the reduced cutting time, handling, operating expense, etc.

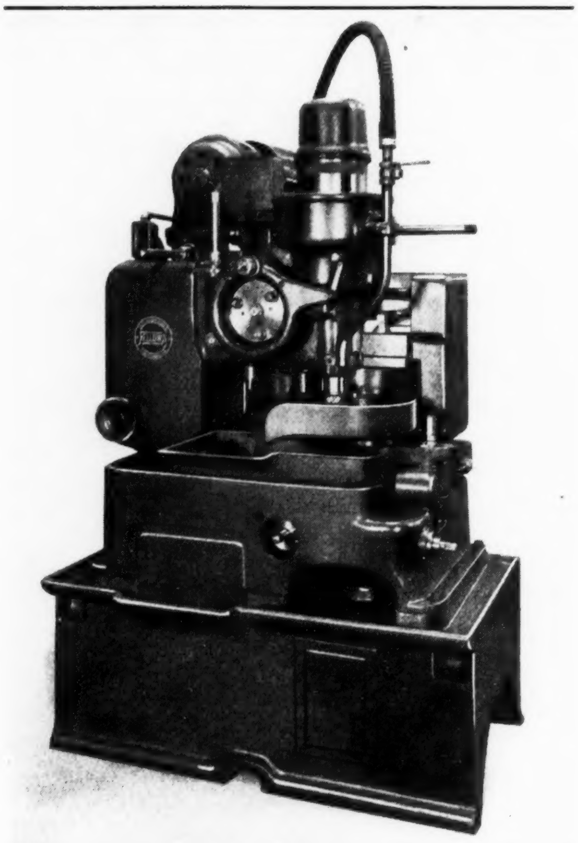


Fig. 1. Fellows Gear Shaper Designed to Use Gap Type Cutters that Rough and Finish Gears in One Operation

This machine employs cutters, the teeth of which are interrupted by one or more gaps, depending upon the diameter and character of the gears to be cut. The gaps permit the loading and unloading of gears without withdrawing the cutter from its operating position. Teeth can be roughed and finished on external spur and helical gears. The cutter is rotated to depth instead of being fed in radially. The teeth on the cutter are a multiple of the number of teeth on the work.

The cutter shown in Fig. 2 is used for cutting a sixteen-tooth helical pinion. The roughing teeth on the cutter are shorter and thinner than the finishing teeth. In using this cutter, the work makes two revolutions to one of the cutter.

The machine is equipped with a motor drive. An automatic electrical control stops the machine when the cutter gap is in the most convenient position for removing and reloading the work. Fig. 3 shows a close-up view of the electrical control box with the cover plate removed to expose the operating mechanism. It will be noted that the limit switch is driven by the upper worm-shaft. Gear-driven cams operate the electrical control mechanism. One cam stops the machine, while the other sets up an electric circuit preparatory to the operation of the stop cam. The driving gears must be in a direct relation to the number of gaps in the cutter. For a one-gap cutter, the ratio is 2 to 1, and for a two-gap cutter, 1 to 1.

In some cases, it is possible to obtain greater accuracy with this special machine than with the standard gear shaper. This is especially true in cutting small pinions of fine pitch, due to a better distribution of the

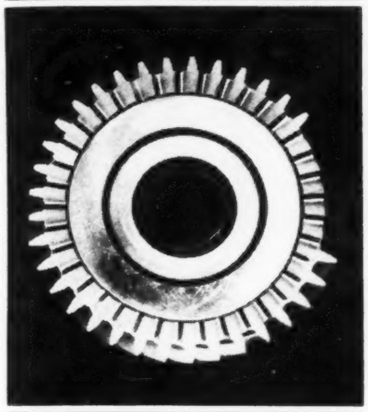


Fig. 2. Gap Type Cutter for a Helical Pinion

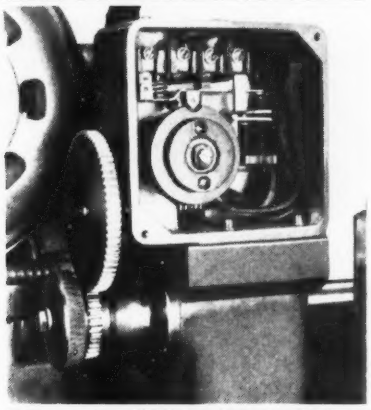


Fig. 3. Electrical Control for the Cutter-spindle

cutting action between the sets of cutter teeth. The electrical equipment comprises a constant-speed motor, a motor starter with a thermal overload protection, interlocking contactors of the make-and-break type, a push-button control station, an automatic stop for use with regular cutters, and the cam-operated limit switch.

The electrical control does not interfere with the use of the regular cutters on the machine. When such cutters are to be used, the limit switch is made inoperative by removing the driving gear from the upper worm-shaft and setting the automatic control for stopping the machine. This special gear shaper has a capacity for gears up to 2 1/2 inches pitch diameter and 6/8 diametral pitch.

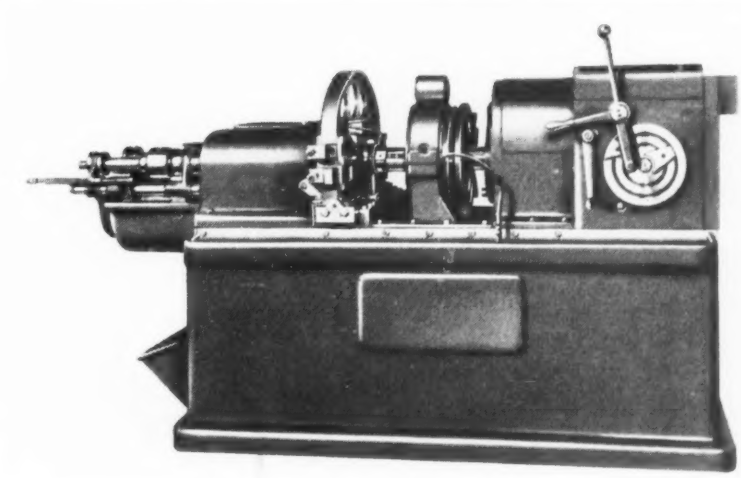
Di-Matic Automatic Screw Machine

Ease of set-up, simplicity of operation and adjustment, low operating costs, the maintaining of close tolerances, and economy on short runs are advantages claimed for the Di-Matic automatic screw machine developed by the Windsor Automatic Co., Inc., Windsor, Vt. This machine has two non-indexing spindles of standard automatic type with draw-in collets of 1 1/2-inch maximum capacity. End tools are mounted in an indexing turret and brought to the work-spindles alternately. A new type of indexing arm is used, which is actuated by a cam that allows a dwell of sufficient time to permit feeding out the stock in the spindles. This indexing is done easily and quickly, as the indexing member is small and of comparatively light weight. The maximum feed length is 6 inches.

The cross-slide is operated by a new type of cam action. It is mounted on a base which is cast in one piece with the headstock. This construction is designed to eliminate backlash and maintain a high degree of accuracy. The forming tools are set in a frame mounted directly on the cross-slide which serves as a permanent tool-holder. The base has an unusually large reservoir for chips and coolant. All operating parts are accessible. The gear-box is oiled by a splash system.

To prevent accidents, it has been made impossible for the operator to start the machine while the hand-crank is in position, and the crank cannot be used until the feed clutch is disengaged. A safety device on the cam drive shaft stops the machine in the event that undue stress is thrown on any part. The high- and low-speed cam disk on the gear-box is always in sight, and is easily adjusted.

Each spindle has its own forming tool, finish-forming tool, and cutting-off tool. These tools are mounted in a rigid frame and carried by the cross-slide. The spindles are mounted in adjustable roller bearings in a solid headstock, permitting the use of unusually heavy feeds. The end working tools, including drills, turners, dies, reamers, and taps are carried in the turret, which indexes in a slide mounted directly in the base of the machine on hardened and ground steel ways. Any number of operations up to seven can be performed at one time.



Di-Matic Automatic Screw Machine Developed by the Windsor Automatic Co., Inc.

Small-size Press Recently Added to Niagara "Master Series" Line

Niagara Small-Size "Master Series" Press

An inclinable press having a shaft 1 1/4 inches in diameter has been added to the "Master Series" line of the Niagara Machine & Tool Works, 637-697 Northland Ave., Buffalo, N. Y. Many of the features found in the larger presses of this line, previously described in MACHINERY, have been incorporated in this small-size press. It is adapted for the manufacture of light metal stampings, such as are used in the jewelry, automotive, aviation, electrical, toy, and similar industries.

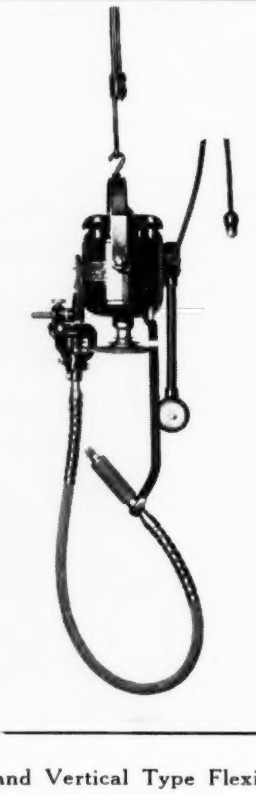
As in the case of the larger machines, the frame is of high-tensile cast iron and is designed to provide the strength and rigidity required for long die life. The fourteen-point engagement clutch gives maximum safety and long life even when operated at maximum speeds. The flywheel and throw-out spindle are mounted on anti-friction bearings. The sleeve clutch is equipped with a positive stop, a locking device, and a single-stroke mechanism.

The slide operates in double-vee adjustable gibs and provides equal support for the die from the center to the front and from the center to the rear. A breech-block die clamp provides solid support for the die. The inclining device is so designed that there is practically no change in the height of the bed when it is in the inclined position.

Strand Three-Speed Flexible-Shaft Machines

A three-speed vertical type has been added to the line of flexible-shaft machines manufactured by N. A. Strand & Co., 5001 N. Lincoln St., Chicago, Ill. This machine is regularly made in 1/6-, 1/4-, and 1/3-horsepower sizes, but larger types may also be furnished.

Various speed combinations are provided in all three sizes, as follows: 1700, 3000, and 5200 revolutions per minute, or 3400, 6000, and 10,400 revolutions per minute. The machines are fully ball-bearing equipped. Speeds can be conveniently changed. Each machine is mounted in a swivel bale and is provided with adjustable tie-rods for suspending it from the ceiling.

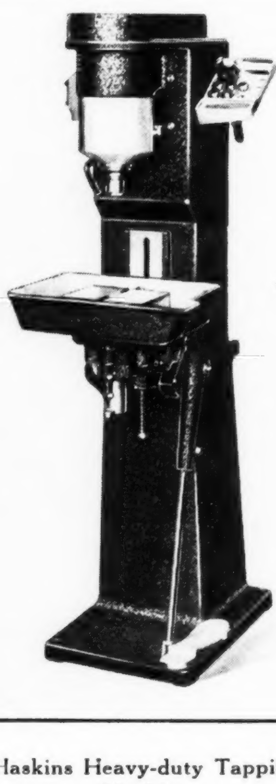


Strand Vertical Type Flexible-shaft Machine

Haskins Heavy-Duty Tapping Machine

The principles embodied in the Nos. 1 and 2 high-speed tapping machines built by the R. G. Haskins Co., 4634 W. Fulton St., Chicago, Ill., have been incorporated in a No. 4 heavy-duty machine for tapping 5/16- to 3/4-inch holes in brass and from 5/16- to 5/8-inch holes in steel, when the work consists of light-weight castings, forgings, stampings, and screw machine products.

The head of the tapping machine is driven by a one-horsepower motor which operates at a speed of 1725 revolutions per minute. The driving pulleys provide three tapping speeds of 550, 750, and 1000 revolutions



Haskins Heavy-duty Tapping Machine

per minute. The reverse speed is double that of the tapping speed. The tap head mechanism, which is removable, is enclosed in a cast aluminum shell.

The tap head is stationary and the work is presented to the tap by raising the table, which is actuated by a foot-pedal. Two cushioning springs absorb any excessive or irregular pressure on the foot-pedal, thus maintaining a constant and sensitive feed. Positive lubrication is provided by a rotary pump, the flow of lubricant being controlled by a hand-operated valve. The tap spindle is so designed that a standard "Acorn" die and holder can be installed in place of the collet chuck for external threading operations.

Ajax Hydraulically Operated Friction Clutches

Hydraulically operated friction clutches of the same design as the pneumatically operated clutches used on the heavy forging machines of the Ajax Mfg. Co., Cleveland, Ohio, have now been made available. They were developed to meet operating conditions in the forge shop of a large automobile manufacturing concern. The only difference between the pneumatic and hydraulic clutches is that oil pressure instead of air pressure is used to operate the piston which acts directly on the multiple clutch plates. A pneumatic clutch was illustrated in the October, 1934, number of MACHINERY, page 116.

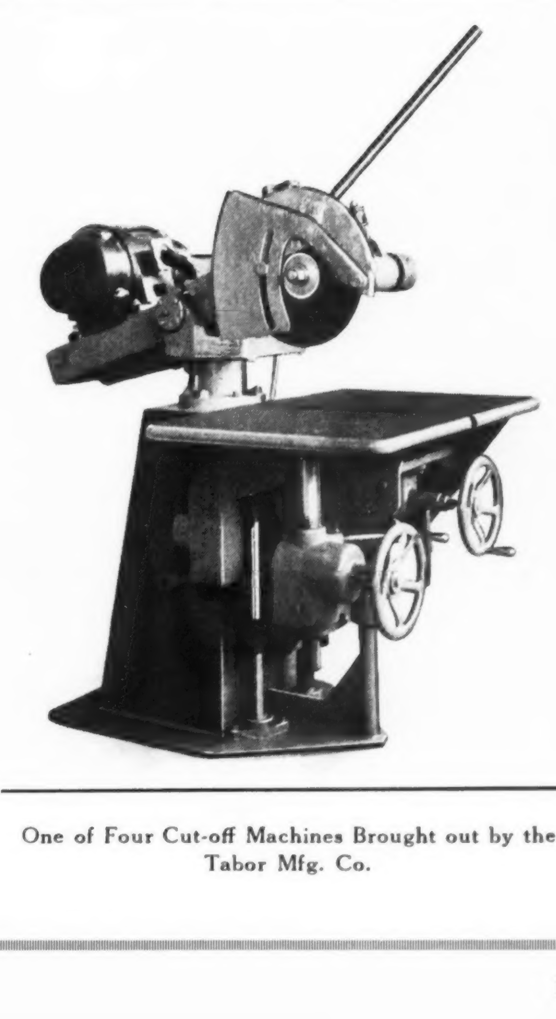
No toggles, wedges, or yokes are employed to transmit pressure, the only operating parts, aside from the piston and plates, being the compression springs which serve to retract the piston and disengage the plates when the hydraulic pressure is released.

A small high-speed pump, driven either by an individual motor or from the machine motor, supplies the hydraulic pressure, making the forging machine an entirely self-contained unit. The clutch torque is controlled by the pressure setting of the hydraulic pump. Provision has been made to prevent leakage of oil from the piston or the rotary connection, so that no oil can reach the clutch plates or be thrown on the floor.

"Tabor-Brasive" Cut-Off Machines

Four types of abrasive-wheel cut-off machines have been brought out by the Tabor Mfg. Co., 6225 Tacony St., Philadelphia, Pa. These machines are adapted for cutting off gates and risers from castings, including Monel metal, hard manganese bronze, phosphor-bronze, etc., and also for cutting bar stock, strip steel, tubing, structural shapes, brick, tile, and refractories. Records of the results obtained in several foundries under actual production conditions have shown savings in time ranging from 92 to 94 per cent over the old methods. With these machines, excess metal can be cut off close to the body of a casting, in many cases entirely eliminating the necessity for snagging or finish-grinding operations, thus speeding up deliveries of work.

These machines are driven by a completely enclosed motor having a push-button starter. A triple V-belt drive is used. The wheel-spindle is mounted in heavy-duty, anti-friction, dust-proof bearings. The wheel and belts are guarded for the protection of the operator. The table is easily adjusted for height, and is made in halves which can be adjusted relative to each other, in order to accommodate work of irregular shape.



One of Four Cut-off Machines Brought out by the Tabor Mfg. Co.

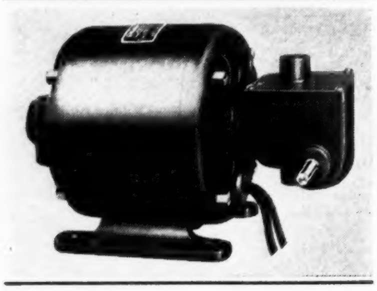
One type of these machines has a stationary head, the work being placed on the table and fed to the wheel by hand. On another type—the one illustrated—the head can be locked stationary or released to permit rocking the abrasive wheel to and from the work. The latter method is used when the shape or size of the piece makes it advisable to clamp the work on the table.

Another type of machine has a traversing head which is brought forward to the work. This type also permits the work to be securely clamped to the table. Still another type has a traveling table, on which the work can be clamped. This type is particularly adapted for taking long cuts.

Fractional-Horsepower Motor with Back-Gear Reduction

A fractional-horsepower motor with a back-gear reduction has been brought out by the Signal Electric Mfg. Co., Menominee, Mich. This motor is available in 1/45 to 1/30 horsepower capacities. It is of the four-pole alternating-current induction shaded-coil type of construction.

The starting arrangement obviates the usual centrifugal switch, condenser, or brush and commutator. This motor has a high starting torque capacity. It can also be furnished in a four-pole, series-wound (brush) type for operation on direct current. The gear reductions give speeds ranging from 1.6 to 150 revolutions per minute. The motor operates on 110 volts, but is available for special voltages.



Signal Motor with Back-gear Reduction

Wrigraph Drafting Machine

A professional model 22- by 30-inch drawing-board with a Wrigraph drafting machine of streamline design has been brought out by L. G. Wright, Inc., 5718 Euclid Ave., Cleveland, Ohio. The parallel-motion mechanism is hand-assembled with all-steel nickel-plated parts and solid phosphor-bronze bearings. This mechanism is carefully calibrated to insure accuracy.

The protractor unit has a vernier scale reading to degrees, and is provided with a chuck plate of special design for holding the drawing attachments in accurate alignment. The graduated L-square blade is made of transparent pyroxylin and is riveted to a light-weight aluminum reinforcing plate which is given a satin finish to eliminate glare.

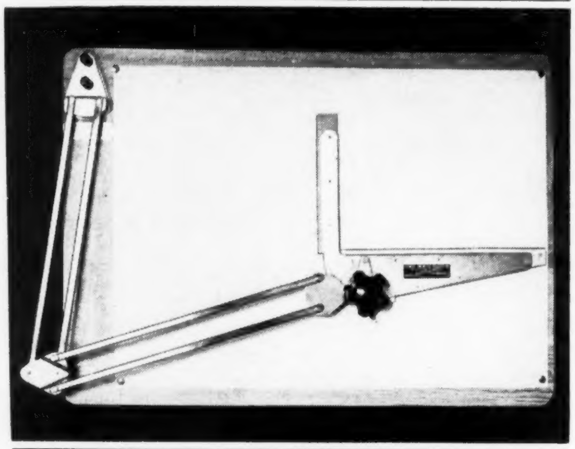
Ajax Mechanical Vibrator

A mechanical device for producing the vibrating or shaking motion required in the operation of various types of conveying, screening, and separating equipment has been brought out by the Ajax Flexible Coupling Co., 12 English St., Westfield, N. Y. This device can be designed to meet specific requirements as to size and speed. The unit shown in the illustration, when running at a speed of 4000 revolutions per minute, delivers 8000 blows per minute, each having a force of approximately 2400 pounds.

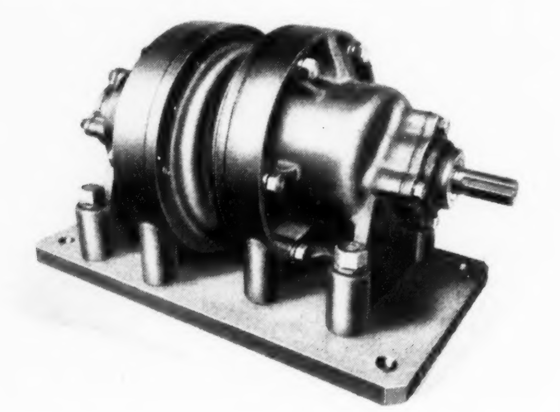
The device consists essentially of two offset weights, mounted on shafts that are so geared together that when one rotates, the other rotates at the same speed but in the opposite direction. The use of two weights instead of one permits directional control of the blows. The operating mechanism is completely enclosed in a housing that is oil-tight and dustproof.

Clark Hook-Groove Round Leather Belting

Two lengthwise grooves are a feature of a new type of round leather belting placed on the market by the Victor R. Clark Belting Co., 605 W. Washington Blvd., Chicago, Ill., for power-driven sewing machines and similar applications. The grooves are located diametrically opposite each other and provide recesses for the metal hook used to join the belt ends. Thus no metal comes in contact with the pulleys. This gives a joint that runs smoothly over the pulleys without bumping and that cannot catch in the operator's clothing or injure his hands.

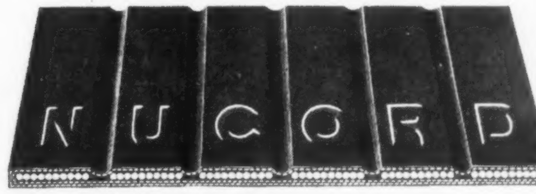


Wrigraph Drafting Machine of Larger Size than Previous Models in this Line



Mechanical Vibrator Capable of Delivering Eight Thousand 2400-pound Blows per Minute

Nucord Multiple Flat Belting



Nucord Belt Consisting of Inch-wide Belts Fastened Together

A multiple flat belting recently brought out by the Nucord Co., 605 W. Washington Blvd., Chicago, Ill., consists of narrow belts fastened together as shown in the illustration. Each section takes its share of the load, giving the belt the flexibility required to enable it to accommodate itself to various pulley crownings and any crosswise or lateral strains it may encounter. As the belt bends over the pulley, the grooves on the outside surface become slightly reversed, thus producing vents which allow the escape of any air that may have become trapped between the belt and the pulley.

The cords in the belt do practically all of the work. They are gum-dipped and then coated with a compound. The fabric is a special woven material, so constructed and treated that it protects the cords against deterioration from heat, water, steam, oil, and acid fumes. Endless belts 3/4 inch to 1 3/4 inches in width are made in lengths of from 37 inches up to 300 feet. Belts 2 to 12 inches wide are made in lengths of from 64 inches up to 300 feet. Roll belting is made in any length up to 500 feet, and in any width from 3/4 inch to 12 inches.

Monarch Direct-Reading Dials for Indicating Carriage Travel

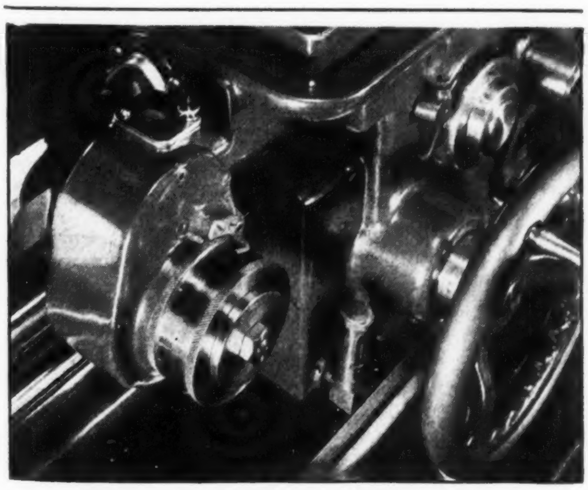
Direct-reading dials can now be applied to all sizes of lathes made by the Monarch Machine Tool Co., Sidney, Ohio. The direct-reading dial mechanism consists of a small oil-tight gear housing approximately 6 3/4 inches high, 5 inches wide, and 5 inches deep. This unit is attached to the left-hand or right-hand wing of the carriage.

A hardened pinion meshes with the lathe bed rack, which, through the gearing in the housing, produces one complete revolution of the inner dial per foot of carriage travel. One inch of carriage travel produces one revolution of the outer dial, which is graduated to indicate sixty-fourths of an inch of carriage travel. Both dials can be quickly reset to zero, so that successive lengths can be measured quickly when performing turning or boring operations. The lengths of several different cuts taken on one piece can be read directly on the dials, thus making it unnecessary to stop the lathe to permit measuring with a scale.

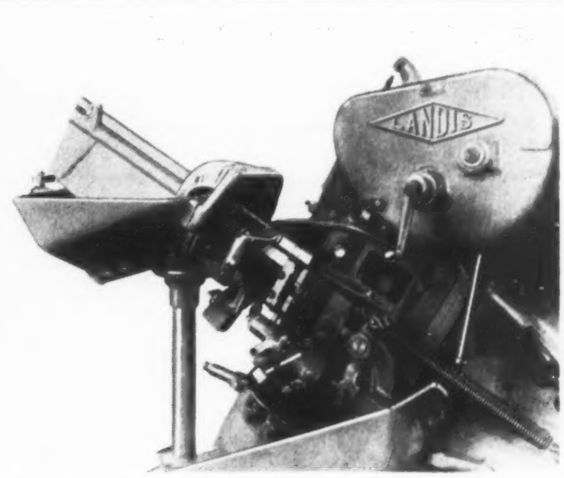
The direct-reading dials are also useful in setting dogs for stopping the table travel, especially when the first piece of a lot is being machined.

Magazine Feed for Landis Forming and Threading Machine

The automatic forming and threading machine manufactured by the Landis Machine Co., Inc., Waynesboro, Pa., can now be used for forming and threading bolts up to 7 1/4 inches long through the application of a recently designed magazine feed. This represents an increase in



Monarch Lathe Carriage Equipped with a Direct-reading Dial that Indicates Carriage Travel



Magazine Feed for Handling Longer Bolts on Landis Automatic Threading Machine

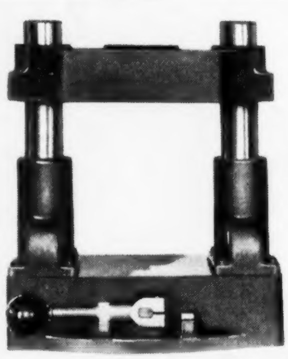
the length capacity of 1 1/4 inches, the regular hopper, which automatically feeds the bolts into the transfer mechanism, being designed to handle bolts up to 6 inches in length.

The new magazine can be attached directly to the hopper of machines now in use by first removing the hopper leaves. The bolts must be placed in the feeding chutes of the magazine by hand. From the chutes, the bolts are automatically fed to the grippers, pointed, threaded, and ejected. For a given bolt, the production rate is identical with that obtained with the regular machine equipped with a hopper leaf for fully automatic feeding.

The capacity range of the magazine provides for threading lengths up to 2 1/2 inches on 3/16-inch to 1-inch bolts from 2 1/2 to 7 1/4 inches long and with head thicknesses up to 1 1/4 inches. The length of the magazine chute is 35 inches. The number of bolts held by the magazine is governed by the size of the bolt head.

Esco Drill Jigs

Six new styles of jigs have been added to the line of the Esco Engineering Service Co., 1922 Linwood Ave., Toledo, Ohio. These jigs are made in forty sizes, and are especially adapted for close grouping on index tables. The compact grouping permits the use of small drill heads and drilling machines.

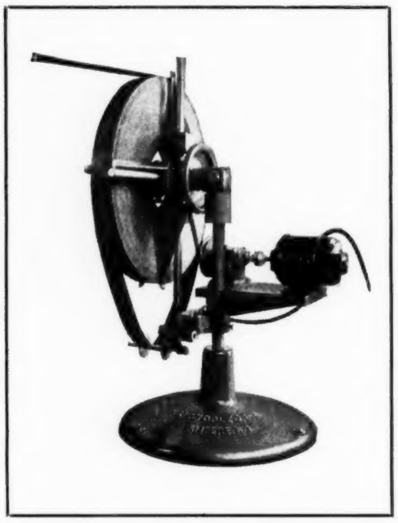


Esco Style E Drill Jig Designed for Compact Grouping

A new arrangement of the Esco locking mechanism—which employs double eccentric gears—is now incorporated under each guide post. This arrangement increases the work-holding pressures. The over-all dimensions have been considerably reduced without decreasing the work areas corresponding amounts. The guide post diameters have been increased to 1 3/4 inches.

Motor-Driven Automatic Stock Reel

A motor-driven stock reel employing a simple mechanism which automatically maintains a



Motor-driven Automatic Stock Reel Brought out by the U. S. Tool Company

loop of stock at the entering side of a metal stamping machine has been brought out by the U. S. Tool Company, Inc., Ampere, N. J. This equipment has been developed to meet the demand for a low-priced stock reel that will prevent the whipping action and strain on stock which commonly occurs when heavily loaded reels are operated, when long feeds are run at high speeds, or when light materials such as paper are fed to the machine. This machine is made in vertical and horizontal quick-loading types and in different sizes and capacities.

Handy Drawing-board which Fits Briefcases

Handy Drawing-Board for the Briefcase

A drawing-board, designated the "Pretty Neat," that weighs less than 1 pound and is of such dimensions that it can be conveniently carried in a briefcase for use in making sketches or drawings in the shop or field is being placed on the market by H. E. Twomley, 7154 Magnolia Ave., Riverside, Calif. There are several sizes of this drawing-board to suit the requirements of engineers, inventors, salesmen, students, etc.; the smallest is intended for holding paper sheets of letter size. The board is made of a natural colored pressed wood that is durable and hard enough to resist marring with a lead pencil. The material has no grain to cause a pencil to deviate from true lines.

One of the unusual features of the board is the provision of spring clamps at the corners for holding the paper securely. These clamps are readily raised by pressing a button on the under side of the board, when it is desired to insert a sheet of paper or release a finished drawing. These clamps, of course, eliminate the need of thumb-tacks.

No T-square is required, as an 8-inch 45-degree triangle can be held squarely against strips that form a border around the board. The ends of the guide strips and the spring clamps are shaped to facilitate extending the end of the triangle over the side of

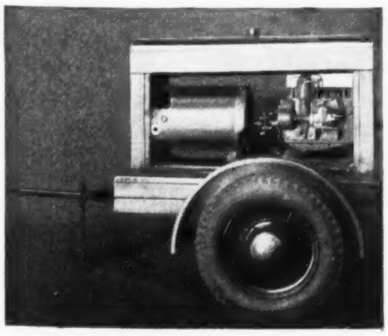
the board. Thus parallel lines can be accurately drawn with the triangle in any required place on the board.

Harnischfeger General Utility Welder

An arc welder of 150-ampere capacity, designed to give high electrical efficiency with the small air-cooled gasoline engine by which it is driven, has been brought out by the Harnischfeger Corporation, Milwaukee, Wis. This welder, known as the Model W-150, is adapted for a wide range of welding work. It uses bare or coated electrodes from 3/32 to 3/16 inch in size for welding materials of varying thicknesses. The welding operation is simplified through the use of a single current control operated by shifting the brush-holders.

For field service, the standard unit can be mounted on a two-wheel highway trailer, as shown in the accompanying illustration. This trailer will travel safely at average motor car speeds when attached to an automobile or truck. The same welder is also available mounted on a small four-wheel industrial truck. For foundry use a skid type mounting can be supplied.

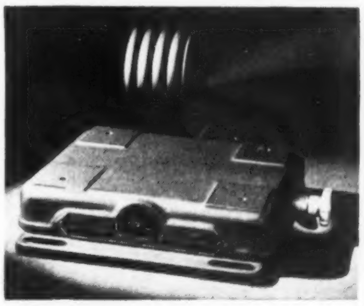
Electric motor driven models can also be supplied in either stationary or portable types, driven by V-belts. The gasoline units are direct-connected and run at a speed of 2200 revolutions per minute. The generator is of standard design with a patented winding which provides a high arc efficiency without the use of external resistors, reactors or separate stabilizers.



Harnischfeger Trailer Type Welder Operated by Gasoline Engine

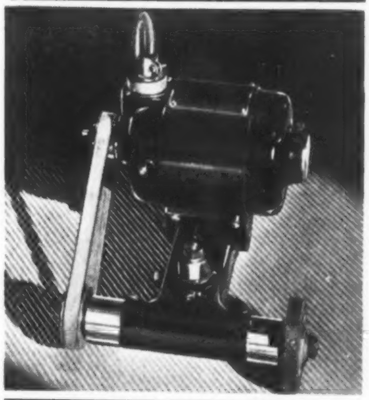
Allis-Chalmers Automatic Motor Base

The automatic ball-bearing motor base here illustrated has been brought out by the Allis-Chalmers Mfg. Co., Milwaukee, Wis., for use with the motion control "Vari-Pitch" Texrope sheave recently placed on the market by this company. It provides a convenient mounting from which to operate the Vari-Pitch sheave and maintains uniform belt tension throughout the speed range. A dial indicator is provided which shows the tension of the V-belts.



Motor Base for Allis-Chalmers "Vari-Pitch" Texrope Drive

The motor and the upper half of the "Straitline" motor base are supported by four ball bearings which are totally enclosed and supplied with sufficient lubricant to last for the life of the unit. This construction assures ease of operation with little or no sliding friction. The travel of the upper half of the base is in a straight line and the lower half is always anchored to its foundation. The handwheel on the base controls the speed of the Vari-Pitch sheave and simultaneously moves the motor a sufficient amount to compensate for the change in the center distance between the shafts which takes place when the diameter of the sheave is varied.



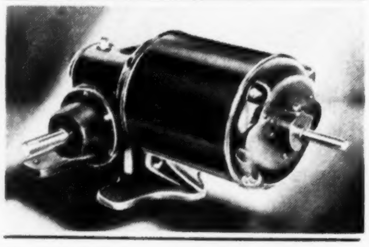
Dumore Grinder for Attachment to Lathe

Dumore Grinding Attachment for Lathe

Spindle speeds ranging from 7000 to 44,000 revolutions per minute are available on the No. 44 "Toolmaker" lathe grinder recently brought out by the Dumore Co., Racine, Wis. This grinder supplements the Nos. 4, 5, and 7 models of the Dumore line and replaces the No. 2-AG model. It will handle many internal and external grinding jobs previously restricted to the larger size grinders.

The universal motor develops 1/4 horsepower. It is equipped with ball bearings and is pivotally mounted to provide a simple means for adjusting the belt tension. The bearings of the grinding spindle are oiled by vertically mounted felt wicks, the oil being fed to tapered "throwers" machined on the spindle. The distance between the spindle and mounting post centers is 1 3/16 inches, which permits using the grinder in lathes having a swing as small as 8 inches. A removable post makes quick set-ups possible.

Each grinder is provided with a steel carrying case and the following equipment: Three mounted wheels with a 1/8-inch shank; a mounted wheel with a 1/4-inch shank; a 2-inch vitrified wheel; a 3-inch vitrified wheel; two "Hi-Speed" fabric belts for the drive from the motor to the grinding wheel spindle; and three wrenches.



Wagner Gear-Motor with Right-angle Shaft Drive

Wagner Fractional-Horse-power Gear-Motors

A line of fractional-horse-power gear-motors that are suitable for direct connection to stokers, agitators, conveyors, low-speed pumps, etc., has been developed by the Wagner Electric Corporation, 6400 Plymouth Ave., St. Louis, Mo. These compact units are provided in single-reduction and double-reduction types with a right-angle shaft drive; and in single-reduction, double-reduction, and triple-reduction types with a parallel shaft drive. They are available with speeds as low as 6 revolutions per minute.

The illustration shows a typical single-reduction right-angle drive unit having an output speed of 30 revolutions per minute and a high-speed extension shaft. The single-phase 1/6-horsepower, ball-bearing motor has a speed of 1725 revolutions per minute. A phosphor-bronze worm-gear in the gear-case is driven by a heat-treated nickel alloy steel worm. The low-speed output shaft is supported by two roller bearings.

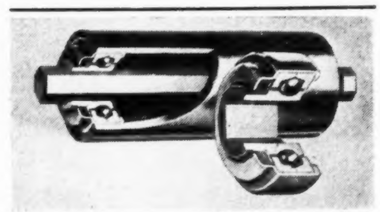
Electrode for Welding Bronze, Brass, and Copper

A phosphor-bronze arc-welding electrode, known as "Aerisweld," has been brought out by the Lincoln Electric Co., Cleveland, Ohio. The high tensile strength of the weld metal produced by this electrode adapts it for fabricating new products or reclaiming old ones of bronze, brass, or copper. A few of the many welding applications are bus-bars, large contacts, impeller blades of pumps and turbines, ornamental bronze, bronze doors, etc.

Many types of bronzes that are difficult to braze can be readily welded with this electrode. It is also useful in welding galvanized sheets when minimum disturbance of the galvanizing is essential. Bronze bearing surfaces can also be built up on steel or cast-iron parts, such as guides, etc.

The electrode is of the shielded-arc type for use with the metallic arc, and is made in 5/32- and 3/16-inch sizes. Its coating, as it burns, produces a gas which shields the molten metal from harmful effects of the atmosphere and facilitates the flow of molten metal in the arc. Preheating of the work is unnecessary for welding any ferrous metal and the lighter grades of copper and bronze. When heavy bronze or copper is to be welded, some preheating may be desirable, due to the high heat conductivity of these metals. Preheating is easily done with a carbon electrode, using negative polarity and rapidly moving the arc over the work.

Dual-purpose Milling Machine Developed by the U. S. Tool Company



Mathews Ball-bearing Conveyor Roller

Mathews Ball-Bearing Conveyor Rollers

Conveyor rollers having hexagonal axles which prevent the inner races of the ball bearings from rotating have been added to the line of "knurled-keylock" conveyor rollers made by the Mathews Conveyer Co., Ellwood City, Pa.

The rollers of this new line are available in lengths to suit requirements and in diameters ranging from 1 inch to 7 1/2 inches. The capacities range from 50 pounds continuous load rating for the 1-inch size up to 8000 pounds for the 7 1/2-inch size. Several intermediate sizes not previously available have been added to the new line, which also includes a tapered roller design. The rollers are made of seamless steel tubing, and the bearing parts are of hardened steel.

Milling Machine for Hand or Semi-Automatic Operation

A milling machine designed for either high-speed semi-automatic milling or for regulation hand milling operations has been developed by the U. S. Tool Company, Inc., Ampere, N. J. This dual-purpose feature makes the machine especially adapted for use in plants having both large production runs and numerous hand milling operations.

The power feed is operated by a cam which provides any desired table speed or combination of speeds. The table speed and the direction of feed are controlled by a single cam and lever designed to eliminate all danger

of "jamming" the work. The hand-lever feed is operated the same as on the regular type of hand milling machine having a horizontal feed.

Armstrong Ratchet Die-Stocks

Ratchet die-stocks have been brought out by the Armstrong Mfg. Co., Bridgeport, Conn., for use with the adjustable and solid thread-cutting dies made by this concern. The stock for the adjustable dies is of the single-handle ratchet type. The No. 2R size has a range of from 1/8 to 1 inch and the No. 3R, from 1/2 inch to 2 inches. Both sizes can be made for right- and left-hand threads.

The ratchet die-stock for the tool-steel solid dies is so designed that a twist of the finger serves to lock the die securely in place. Another twist releases the die without requiring the use of a screwdriver. The No. 51R die-stock will thread pipe from 1/8 to 1 inch, and the No. 52R, pipe from 1/2 to 2 inches. With this type of die-stock also, either right- or left-hand threads can be cut.

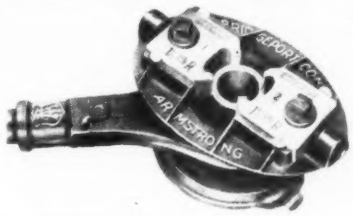


Fig. 1. Ratchet Type Die-stock for Armstrong Adjustable Dies

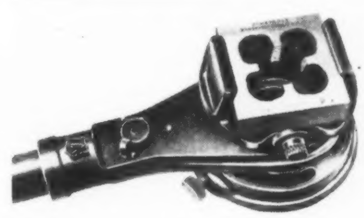


Fig. 2. Armstrong Ratchet Die-stock for Solid Type Dies

Both types of die-stocks are adapted for use in inaccessible places, less than a quarter turn of the die-stock handle being required in cutting a thread. The ratchet movement is quickly reversible. A pawl trigger is set by a movement of the operator's thumb into position for cutting either right- or left-hand threads or into a neutral position.

Oilstoning Tools to Increase Efficiency

By HECTOR J. CHAMBERLAND

Apparently it is the belief in many machine shops that the oilstone is intended primarily for woodworkers. This is an antiquated idea. For best results, lathe, drilling, and milling machine operators should be supplied with oilstones. The cutting edges of all metal-cutting tools should be stoned for exactly the same reason that lapping is employed to lessen wear.

Minute chips adhere to the cutting edges of the tools and gradually cause the sharp edge to disappear. The cutting edge of a tool sharpened by ordinary methods, when viewed under a 25 power magnification, appears very much like a 30-point hacksaw blade. "The finer the edge, the smoother the cut" applies to all cutting tools.

Oilstoning and chromium plating have greatly increased the life of metal-cutting tools in many cases. The relatively high efficiency of chromium-plated twist drills can be increased still more by stoning the cutting lips. In some cases, the efficiency of the chrome plating can be increased from 30 to 40 per cent by stoning. If a drill has a tendency to hog in, stoning the edges to a slight flat will usually overcome the trouble. The same applies to reamers. If the corners or chamfers of reamers are correctly stoned to a 1/64-inch radius, the high finish obtained will eliminate a costly grinding operation in many instances.

Thread chasers, boring tools, forming tools, and milling cutters will show a remarkable increase in production capacity as a result of frequent applications of an oilstone. Recently the writer visited a machine shop where a gang of eight milling cutters was in operation. On learning that these expensive cutters had to be reground every morning, he suggested that an occasional pass of an oilstone over the cutting edges of the tools would increase their life. As the cost of removing these cutters from the arbor, including lost production, time for grinding, assembling, etc., amounted to $4, it was thought worth while to try out the suggestion. As a result, a ten-minute stoning job every two hours has increased the time between grinds five to six hours.

Regardless of the steadily increasing use of cutting tools tipped with carbides, the writer believes that high-speed steel tools will continue to be used and that their life can be materially increased by giving oilstoning more consideration. Operators are not likely to buy the necessary oilstones, however, and they can hardly be expected to do so any more than they are expected to buy drills and reamers. With this in mind, the writer believes that it is the part of good management to furnish machine operators with oilstones.

* * *

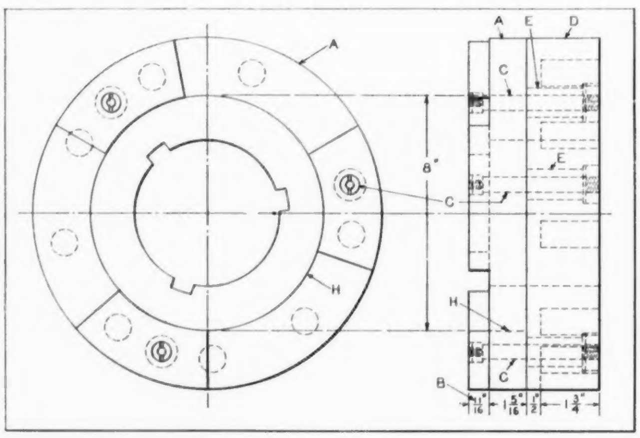
Broaches up to 68 inches in length and 8 inches in width or diameter are now being handled by machines that may be considered standard types. A machine of this size may have a cutting speed of 18 feet per minute, with a return speed of 24 feet.

Safety Block Clutch for Large Press

By WILLIAM C. BETZ, Equipment Engineer
Fafnir Bearing Co., New Britain, Conn.

After the frame on a back-geared press of 65 tons capacity had been broken twice within a year by accidental overloading, the block clutch was equipped with shear pins *C*, as shown in the accompanying illustration. The first break was near the left bearing and was repaired by welding. The second break was just below the weld.

The clutch block which slides on the crankshaft was first removed. Then the three hardened striking plates were removed from the clutch face. The face was next turned down and faced off for a depth of 11/16 inch, as indicated at *B*, leaving a hub *H* on body *D* having a diameter of 8 inches. A new hardened ring *A* with a clutch face milled in it as shown was then assembled on the hub of the body *D*. This new face was provided with three reamed holes for the shear pins *C*. The body *D* was spotted from the three pin-holes and then drilled and bored to receive hardened bushings *E* which act as shear edges when an excessive load is placed on the machine.



Clutch for Back-geared Press Equipped with Shear Pins

The new ring *A* was made of S A E 3312 steel, subjected to the following heat-treatment: Carburize eight hours at 1600 to 1650 degrees F. and allow to cool in carburizing pot; reheat to 1575 degrees F. and quench in oil; reheat to 1450 degrees F. and quench in oil; draw at a temperature of 360 to 400 degrees F. and allow to cool in atmosphere. After this heat-treatment, the steel showed a Rockwell hardness reading of 54 to 56. This special steel of a high tensile strength and core toughness is necessary because of the constant pounding, which tends to break down the steel.

In order to avoid weakening the block *D* unduly, it was found necessary to use shear pins not larger than 3/4 inch in diameter. Heat-treated S A E 2330 steel pins of this diameter were selected as having sufficient shear strength to carry the working load. A 3/4-inch sample pin of this material, tested on a Riehle machine, sheared at 21 1/2 tons. On this basis, the total shearing strength of the three pins would be about 65 tons, or the equivalent of the press capacity. The heat-treatment of the pins consisted in heating to 1475 degrees F., quenching in oil, and drawing to a temperature of 800 degrees F.

The pins were threaded and made with a shoulder so that they would serve to hold the ring *A* on the clutch block *D*, and at the same time act as shear pins. Holes were drilled and tapped in the heads of the pins for a 1/4-inch screw to facilitate removal in case they were sheared. The block *D* was counterbored at the back to receive the round nuts used on the shear pins. Light lock-washers were used under the heads of these nuts. The heads of the pins and also the nuts were slotted to permit turning them with a screwdriver. In case the pins are sheared, it is only necessary to slip the flywheel forward on the crankshaft about 5 inches, screw a short stud into the head of the broken stud, and pull out the broken part. The clutch block is then slid out to the flywheel and the stud-puller is inserted in the threaded end of the pin in order to remove the remaining portion of the shear pin and nut.

To insert new pins, the clutch block is pushed back against the shoulder of the crankshaft, the three screws are inserted, and the block slid away from the shaft shoulder about 2 inches. The washers and nuts are next put in place and the nuts tightened. The flywheel can then be slipped back and the shaft replaced, thus making the press ready for service.

* * *

The American Economic System is Economic "Voluntarism"

Our economic system is essentially a voluntary system, under which men work together on the basis of voluntary agreement, or contract, rather than on the basis of coercion, or the authority of the few and the obedience of the many.

It is not essentially a system of competition, though competition will exist under any voluntary system; of laissez faire, though within the field of useful work, men are let alone; of private property, though private property will exist in any voluntary system; of capitalism, though capitalism will exist in the absence of coercion; of markets, though markets will exist wherever men are free to buy and sell; of profits, though profits will exist wherever men are free to work for themselves.

"Voluntarism" is more fundamental than any of the above-named characteristics of our system, since they all depend for their existence upon freedom from violence, freedom to work together by voluntary agreement, freedom to own, to buy and sell, and to enjoy what one has produced or purchased.—*Dr. T. N. Carver in his book "What Must We Do to Save Our Economic System?"*

NEWS OF THE INDUSTRY

California

J. C. Gowing Welding Equipment & Supply Co., Laura and Regent Sts., Huntington Park, Calif., has been appointed exclusive distributor in southern California for the electric arc welders made by the Hobart Bros. Co., Troy, Ohio.

Connecticut

Johannes Erler, metallurgist of the Farrel-Birmingham Co., Ansonia, Conn., has been selected as the author of the American Foundrymen's Association's exchange paper to the International Foundry Congress in Düsseldorf, Germany, September 15 to 20. The paper will be entitled, "Studies of Casting Stresses in Chilled Iron," and will deal primarily with stresses existing in chilled iron rolls.

L. H. McClure has been promoted to the position of Colt-Noark sales manager for the Colt's Patent Fire Arms Mfg. Co., Hartford, Conn. Mr. McClure has been associated with the company since 1918.

Georgia

R. S. Armstrong & Bros. Co., 676 Marietta St., Atlanta, Ga., has been appointed representative for Alabama, Georgia, South Carolina, and southern North Carolina of the Michigan Tool Co., Detroit, Mich., manufacturer of the Mitco line of small tools, including hobs, shaper cutters, special forming tools, Mitco Pin-Splice tools, etc.

Michigan

S. C. Merrill has been appointed eastern district manager of the Automotive Division of the Timken Roller Bearing Co., Canton, Ohio, with headquarters in Detroit. Mr. Merrill spent several years in the New York territory in production and sales work before joining the Timken organization in 1924.

Miles E. Standish has been appointed sales manager for the Marble-Card Electric Co., Gladstone, Mich., manufacturer of electrical machinery. Mr. Standish was formerly connected with the Louis Allis Co., the Burke Electric Co., and the Imperial Electric Co.

Harry B. Clapp has joined the staff of the Clark Tructractor Co., Battle Creek, Mich., as transportation engineer. Mr. Clapp will make his headquarters at Battle Creek, serving as special engineering assistant to Edgar W. Clark, vice-president.

New Jersey

Worthington Pump & Machinery Corporation, Harrison, N. J., announces that the city of Los Angeles has placed a contract with the company for what is believed to be the largest pumping units ever built in this country—six centrifugal pumps of 12,000 horsepower each. The pumps have a capacity of 90,000 gallons a minute each, against a head of 460 feet.

Newark Wire Cloth Co., Newark, N. J., has appointed Robert H. Brinton, 1640 Castle Court, Houston, Tex., as Texas representative of the company. Mr. Brinton's address is P. O. Box 1970, Houston.

New York

R. K. Le Blond Machine Tool Co., Cincinnati, Ohio, announces the opening of a direct sales office and display floor at 103 Lafayette St., New York City. The company is combining its machine tool division and the Cincinnati electrical tool division at that address. Owing to this arrangement, Wilson-Brown, Inc., 30 Church St., New York City, will no longer act as representative for the company. W. E. Groene, eastern sales representative for the last eight years, will be in charge of the New York office.

Joseph A. Anglada announces the opening of a new office at 11 Park Place, New York City, as engineering consultant specializing in automotive projects. Mr. Anglada will conduct research and development work, including the design and building of parts or complete machines. The work will include investigation, laboratory or other tests, reports, and assistance in patent and other legal matters. Commercial development and marketing of new devices and inventions will also be undertaken.

Kenneth S. Valentine has been appointed district manager at New York for the Patterson Foundry & Machine Co., East Liverpool, Ohio. Mr. Valentine was sales manager of the Turbo Mixer Corporation of New York for eight years. He will have charge of sales in Metropolitan New York and in New England, and, in addition, will act in an advisory capacity on mixing problems in general.

F. B. Yates has been made manager of the New York district office, in charge of industrial sales, for the Timken Roller Bearing Co., Canton, Ohio. He became connected with the Timken organization in 1926. R. W. Powers has been transferred from the Canton engineering department to the New York district office as sales engineer, assisting Mr. Yates.

Owen-Dyneto Corporation, Syracuse, N. Y., announces that all USL arc-welding equipment, formerly made by the USL Battery Corporation, at Niagara Falls, N. Y., is now being manufactured and sold by the Owen-Dyneto Corporation. The entire engineering staff, machinery and equipment have been moved from Niagara Falls to Syracuse.

Atlas Press Co., Kalamazoo, Mich., manufacturer of Atlas lathes, drill presses, arbor presses, and shop equipment, has recently opened a New York sales and export office in the Bush Terminal Sales Bldg., 130 W. 42nd St. John E. Penniman, eastern sales manager, will be in charge.

Detroit Rex Products Co., 13005 Hillview Ave., Detroit, Mich., manufacturer of solvent degreasers, non-inflammable solvents, alkali cleaning compounds, and enamel strippers, has moved the offices of its eastern sales region to Room 816, Bush Terminal Sales Bldg., 130 W. 42nd St., New York City.

Ohio

Contract Welders, Inc., 4829 Lexington Ave., Cleveland, Ohio, announces that it has acquired the Industrial Welding & Cutting Co., 4400 Perkins Ave., Cleveland, and will operate the two plants as divisions of Contract Welders, Inc., in their present locations until April 1, when they will be consolidated in one plant at 2545 E. 79th St., Cleveland. C. C. Peck, president of Contract Welders, Inc., since its founding, will head the consolidation, and Everett Benedict, formerly manager of the Industrial Welding & Cutting Co., will serve as vice-president in charge of sales.

R. H. Sonneborn has been appointed special sales representative of the Tubular Division of the Republic Steel Corporation, Cleveland, Ohio. Charles W. East has been appointed district sales manager of the company at Houston, Tex. Mr. East was previously assistant manager of sales in the Pipe Division. He succeeds Robert E. Lanier.

S. C. Partridge has been appointed assistant general manager of the Indus-